

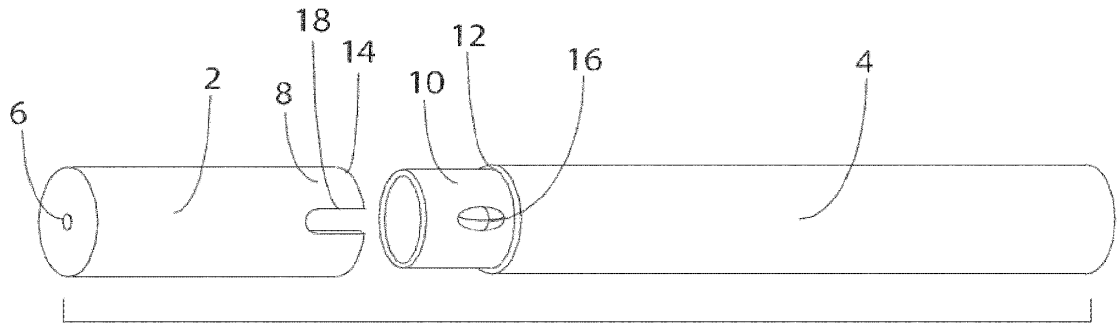


Figure 7

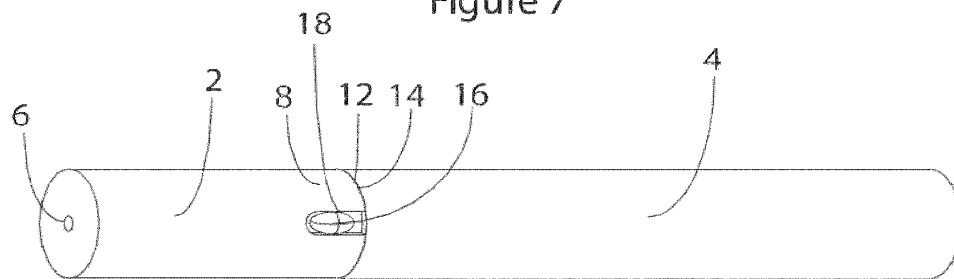


Figure 8

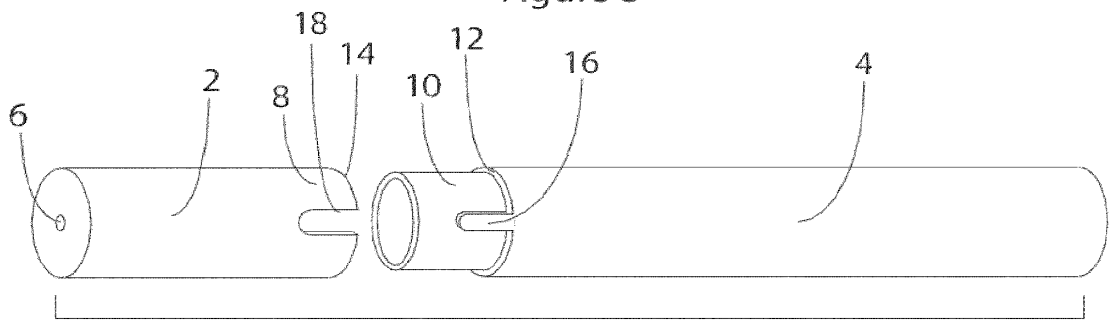


Figure 9

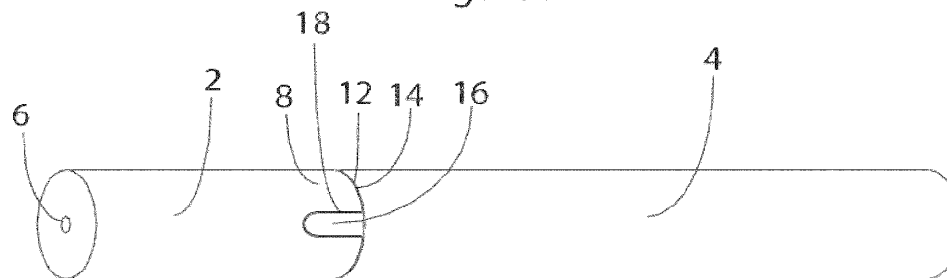


Figure 10

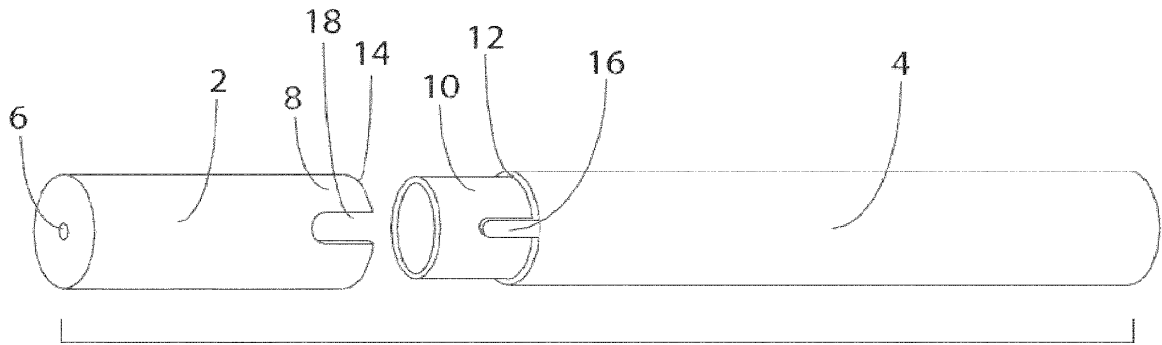


Figure 11

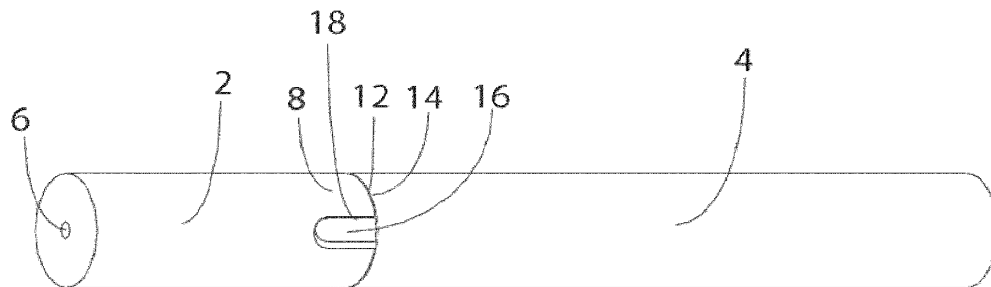


Figure 12

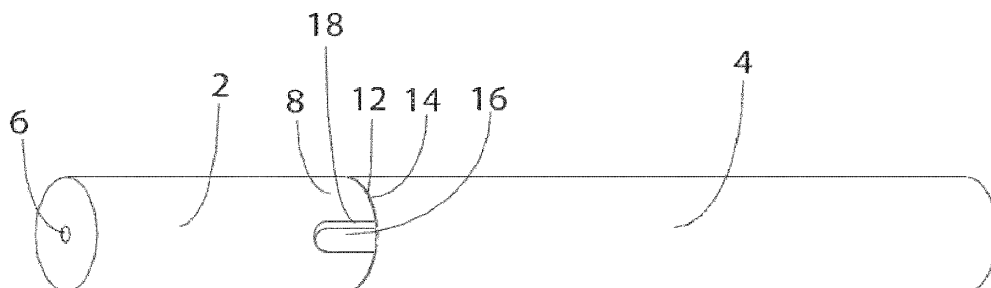


Figure 13

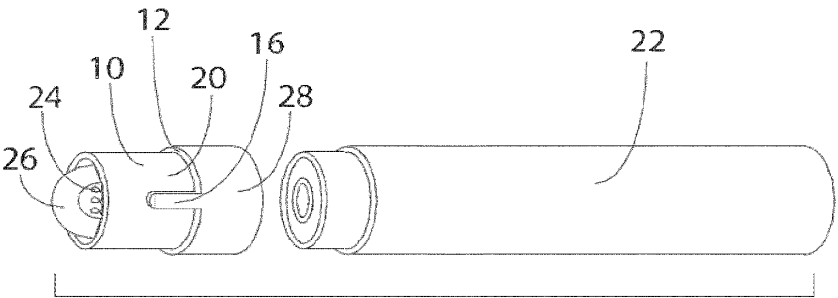


Figure 14

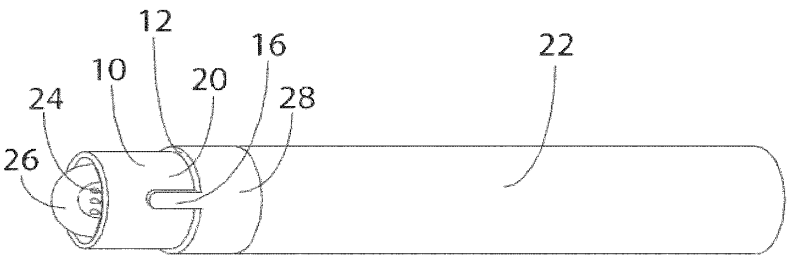


Figure 15

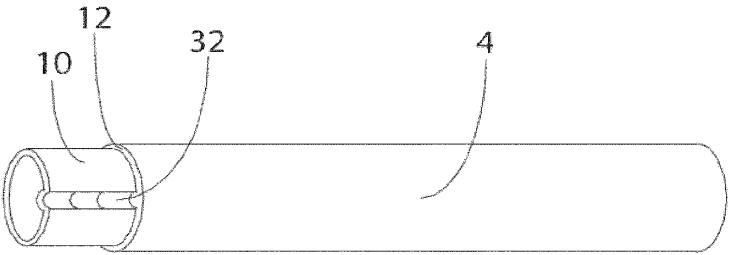


Figure 16

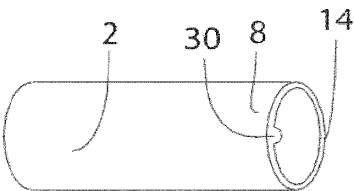


Figure 17

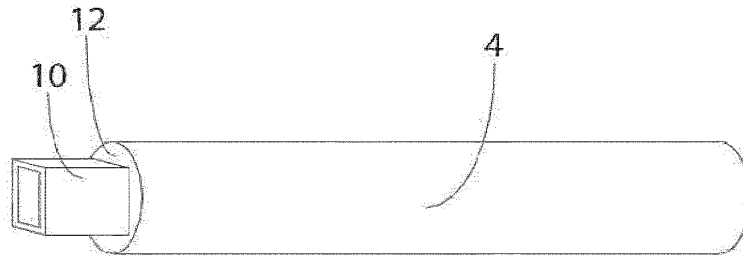


Figure 18

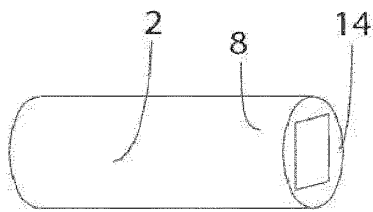


Figure 19

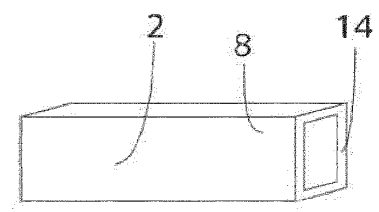


Figure 20

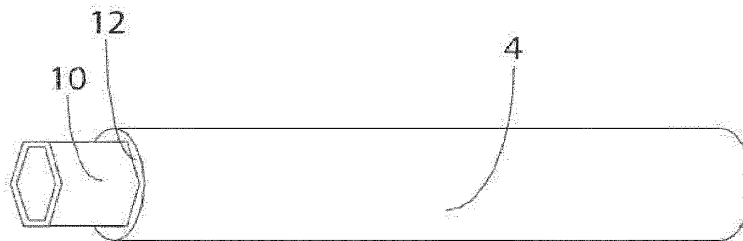


Figure 21

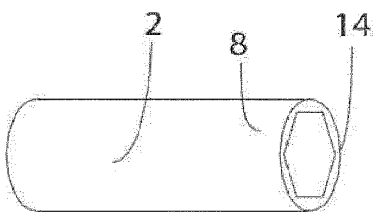


Figure 22

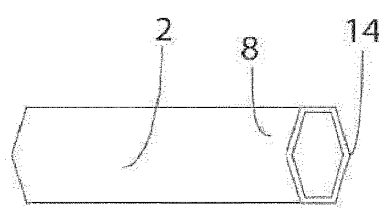
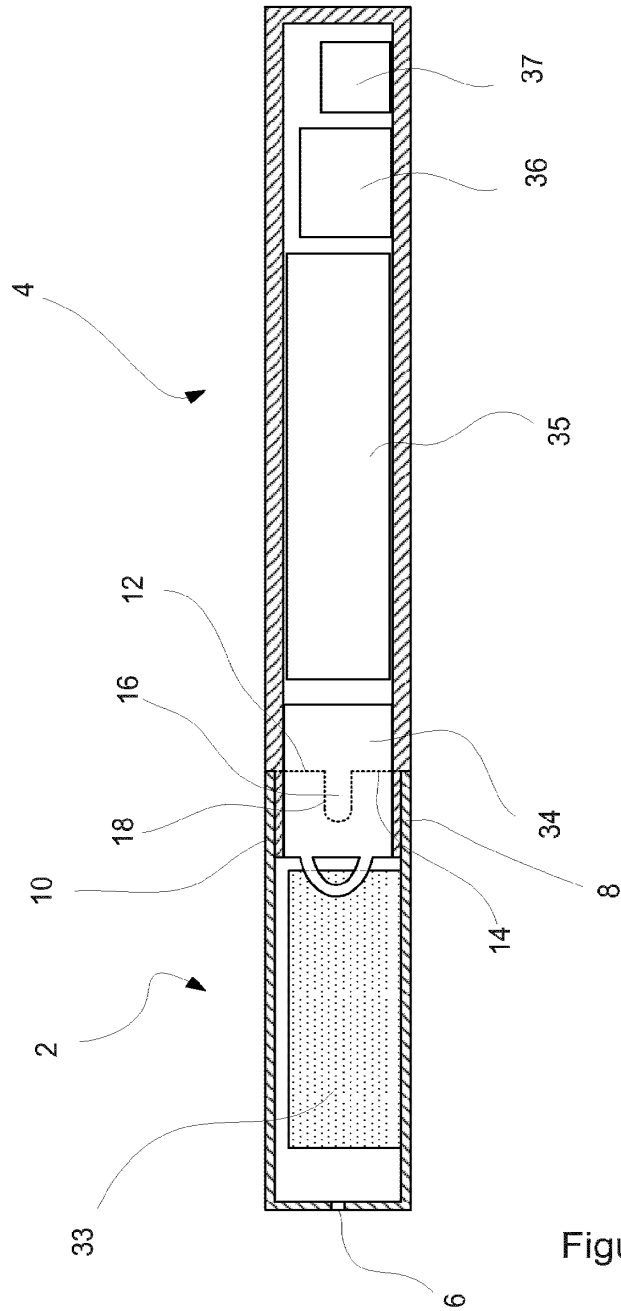


Figure 23



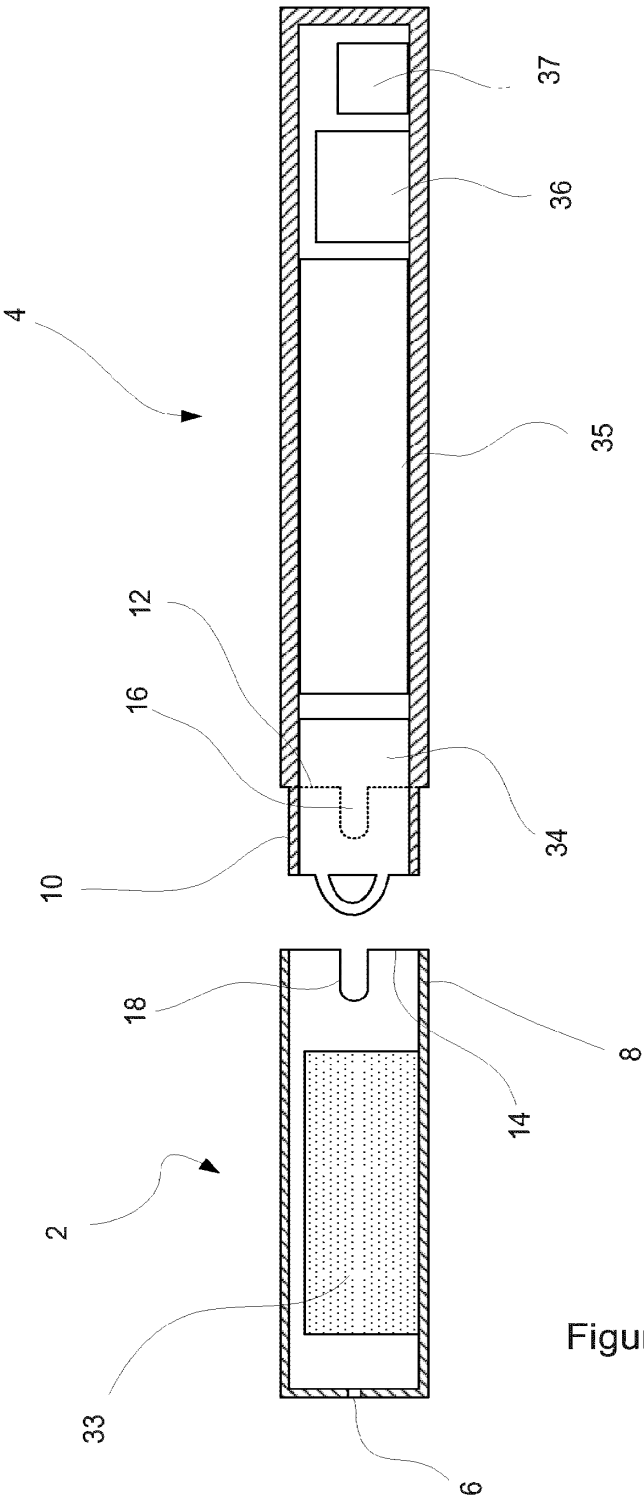


Figure 25

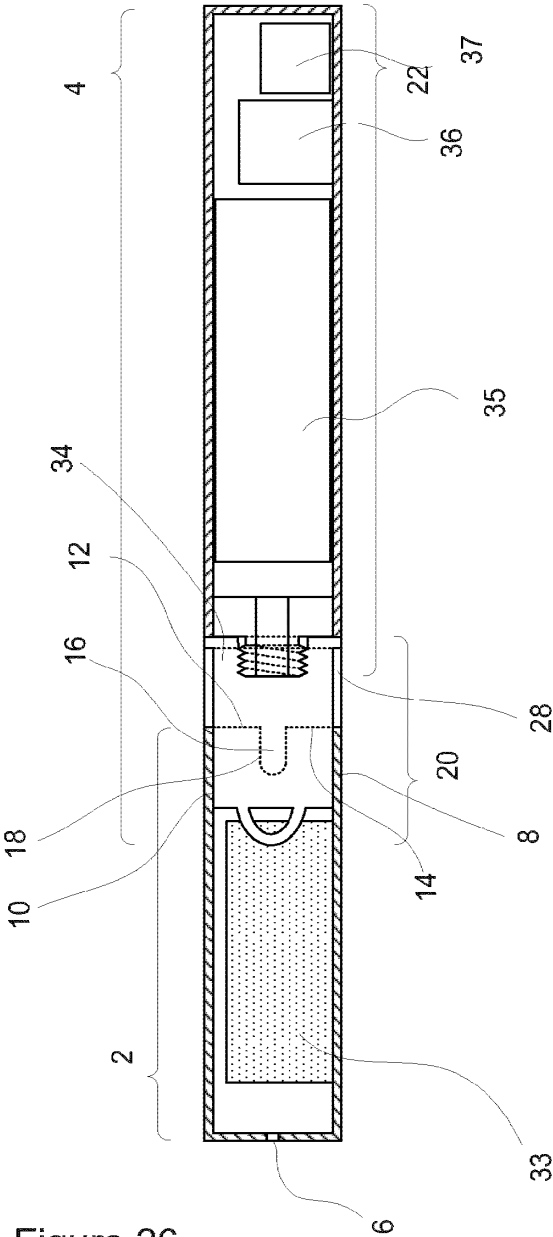


Figure 26

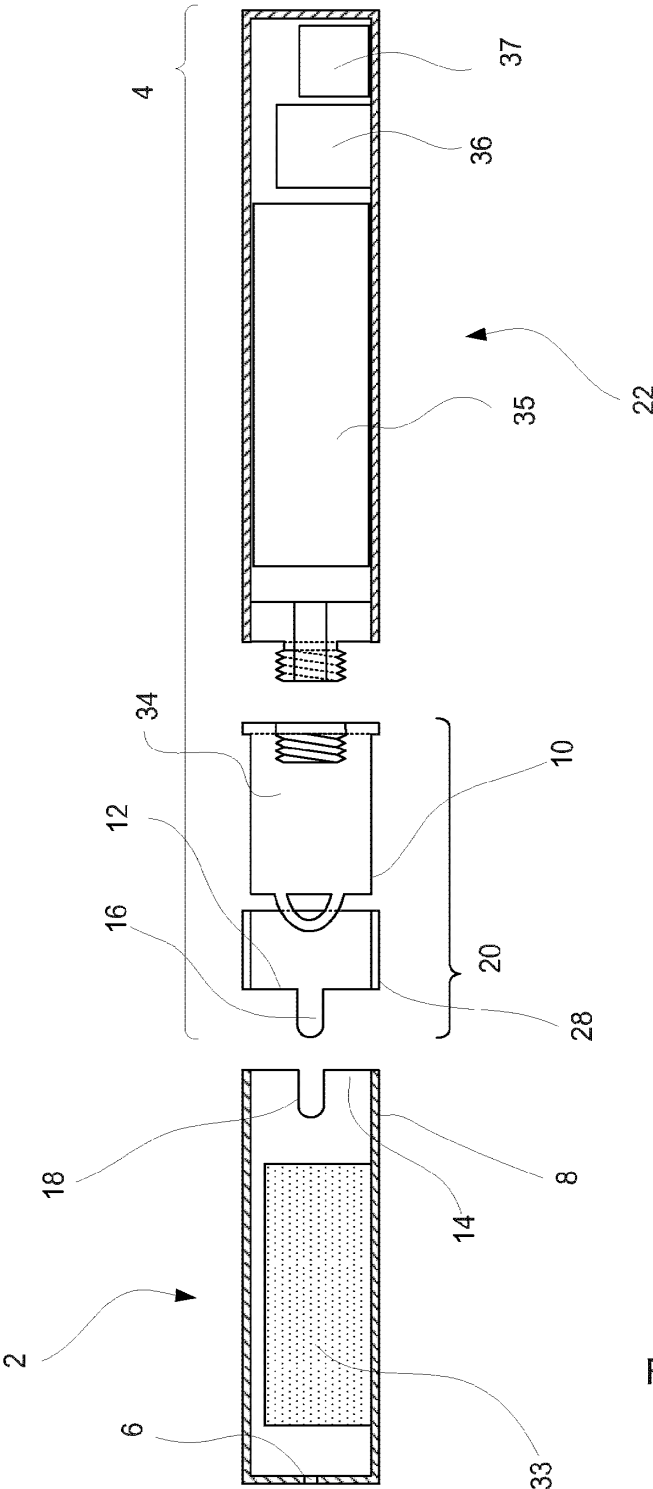


Figure 27

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/059932

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24F47/00 A61M15/06
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 A61M

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/140841 A2 (EBACO CO LTD [KR]) 9 December 2010 (2010-12-09) abstract; figures 9-13,18 -----	1-9, 11-17
X	US 2010/031968 A1 (SHEIKH TARIQ [GB] ET AL) 11 February 2010 (2010-02-11) paragraph [0058] - paragraph [0059]; figures 5,1 -----	1-17
X	EP 1 989 946 A1 (RAUCHLESS INC [US]) 12 November 2008 (2008-11-12) paragraph [0013] - paragraph [0028]; figures -----	1-17
X	US 2011/036346 A1 (COHEN SCOTT A [US] ET AL) 17 February 2011 (2011-02-17) paragraph [0019] - paragraph [0028]; figures ----- -/-	1-3, 11-17

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

23 July 2013

Date of mailing of the international search report

30/07/2013

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Marzano Monterosso

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/059932

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/011396 A1 (FANG XIAOLIN [CN]) 20 January 2011 (2011-01-20) paragraph [0016]; figure 4 -----	1-3, 11-17
X	US 5 322 075 A (DEEVI SEETHARAMA C [US] ET AL) 21 June 1994 (1994-06-21) the whole document -----	1-3, 11-17
X	US 2010/319686 A1 (SCHENNUM STEVEN MICHAEL [US]) 23 December 2010 (2010-12-23) paragraph [0024] - paragraph [0038]; figures -----	1-17
X	WO 2011/104829 A1 (JAPAN TOBACCO INC [JP]; WATANABE TOMOICHI [JP]; ISHII SHINJI [JP]) 1 September 2011 (2011-09-01) abstract & EP 2 540 333 A1 (JAPAN TOBACCO INC [JP]) 2 January 2013 (2013-01-02) paragraph [0049] - paragraph [0054]; figures 6,7 -----	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/059932

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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Published:

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(54) Title: TIP CHARGING ELECTRONIC CIGARETTE AND SYSTEM AND METHOD FOR CHARGING THE SAME

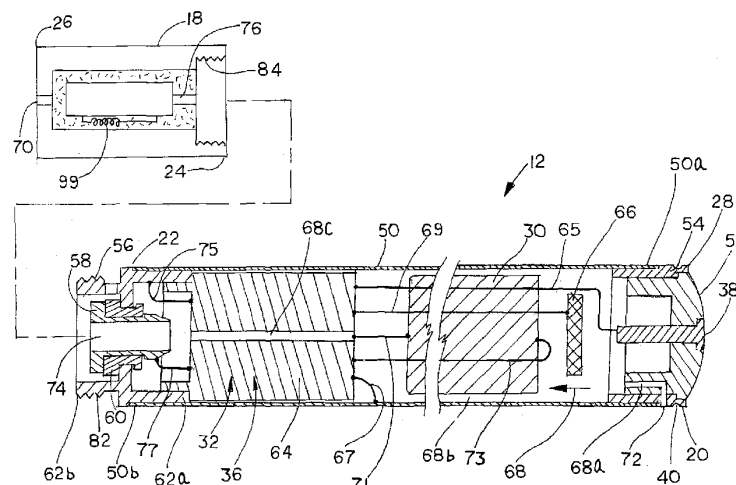


FIG. 2

(57) Abstract: A tip charging electronic cigarette includes a cigarette body including a shell and a mouthpiece, the shell having a forward portion terminating in a tip. The cigarette body further includes a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly. A center charging contact is disposed adjacent the tip, an annular charging contact is disposed adjacent the tip, and the center charging contact and the annular charging contact are operatively coupled to the charging circuit. The center charging contact and the annular charging contact are arranged for connection to cooperating electrical contacts of a charger assembly, wherein the battery is arranged to be charged upon engaging the tip with the charger assembly.

TIP CHARGING ELECTRONIC CIGARETTE AND SYSTEM AND METHOD FOR CHARGING THE SAME

BACKGROUND OF THE INVENTION

Field of the Disclosure

[0001] The present invention relates generally to electronic cigarettes and, more particularly, to front or tip charging electronic cigarettes, and to a system and method for tip charging an electronic cigarette.

Background of the Invention

[0002] Electronic cigarettes, or e-cigarettes, are gaining favor as an alternative to more traditional cigarettes. Electronic cigarettes may be used in some areas where smoking is disfavored, and consequently offer users an additional measure of flexibility regarding where the electronic cigarettes may be used.

[0003] Generally speaking, electronic cigarettes simulate the act of tobacco smoking by producing a nebulized or vaporized mist, which typically includes nicotine, although nicotine-free versions are also available. The mist or vapor produced by electronic cigarettes is inhaled in a manner similar to traditional smoking. According to many users, electronic cigarettes offer the same or similar appearance, feel, flavor and sensation of more conventional smoking.

[0004] Electronic cigarettes typically include a small liquid reservoir which carries the nicotine, a heating element, and a power source. The power source is most commonly a battery, although some electronic cigarettes may be wired to other power sources, such as a wired USB adapter or other suitable power source. Not only are electronic cigarettes portable and self-contained, they are intended to mimic the look and feel of traditional cigarettes. Moreover, many electronic cigarettes also are reusable when provided with replaceable and refillable components.

[0005] Electronic cigarettes most often include a rechargeable battery, which of course must be periodically recharged. Conventional systems require the user to partially disassemble the device in order to connect the battery to the charger. Consequently, users presently desire an easier and more convenient way to recharge the battery in electronic cigarettes.

SUMMARY OF THE DISCLOSURE

[0006] In accordance with one exemplary aspect, a tip charging electronic cigarette system comprises a cigarette body including a shell and a mouthpiece, with each of the shell and the mouthpiece having a forward portion and a rearward portion. The forward portion of

the shell terminates in a tip, and the forward portion of the mouthpiece is removably coupled to the rearward portion of the shell. The cigarette body further includes a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly. The electronic cigarette includes a center charging contact disposed adjacent the tip, and an annular charging contact disposed adjacent the tip, with the center charging contact and the annular charging contact operatively coupled to the charging circuit. A charger assembly is arranged for connection to a power source, with the charger assembly having a cavity arranged to receive the forward portion of the shell, and with the charger assembly further including first and second electrical contacts disposed within the cavity, with the first electrical contact arranged to make electrical connection with the center charging contact and the second electrical contact arranged to make electrical connection with the annular charging contact to permit charging of the battery when the tip is disposed in the cavity of the charger assembly.

[0007] In accordance with a second exemplary aspect, a method of charging an electronic cigarette comprises providing a cigarette body including a shell, a mouthpiece, a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly, and providing a forward portion of the shell with a tip having a center charging contact and an annular charging contact, with both the center and annular charging contacts electrically coupled to the charging circuit and disposed adjacent the tip. The method further includes providing a charger assembly arranged for connection to a power source, with the charger assembly having a cavity arranged to receive the forward portion of the shell, and with the charger assembly including a first electrical contact disposed within the cavity and positioned to engage the center charging contact, the charger assembly further including a second electrical contact disposed within the cavity and positioned to engage the annular charging contact, coupling the charger assembly to a power source, and inserting the forward portion of the shell having the tip into the cavity of the charger assembly to bring the center and annular charging contacts of the tip into engagement with the first and second electrical contacts, respectively, of the charger assembly to charge the battery.

[0008] In accordance with a third exemplary aspect, a tip charging electronic cigarette comprises a cigarette body including a shell and a mouthpiece, the shell having a forward portion terminating in a tip. The cigarette body further includes a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly. A center charging contact is disposed adjacent the tip, an annular charging contact is disposed adjacent the tip, and the center charging contact and the annular charging contact are operatively coupled to the charging circuit. The center charging contact

and the annular charging contact are arranged for connection to cooperating electrical contacts of a charger assembly, wherein the battery is arranged to be charged upon engaging the tip with the charger assembly.

[0009] In further accordance with any one or more of the foregoing first, second or third aspects, a dual stage regulator and/or method may further include any one or more of the following preferred forms.

[0010] In some preferred forms, the cigarette body includes an air flow path extending from the shell, through the cartomizer, and to an aperture adjacent the rearward portion of the mouthpiece, and the cartomizer may be disposed in the mouthpiece and arranged to receive power from the battery via the switch assembly. The forward portion of the mouthpiece may include an inner contact and an outer contact, with the inner and outer contacts of the mouthpiece being electrically isolated from one another and electrically coupled to the cartomizer. The rearward portion of the shell may include an inner contact and an outer contact being electrically isolated from one another and electrically coupled to the switch assembly, with the inner contacts of the mouthpiece and the shell and the outer contacts of the mouthpiece and the shell, respectively, arranged to contact one another when the mouthpiece is attached to the shell. The air flow path may extend through inner contact of the mouthpiece and the inner contact of the rearward portion of the shell.

[0011] In further preferred forms, the charger assembly includes a USB connector. The first electrical contact of the charger assembly may include a spring-loaded pin. The forward portion of the shell may include an annular groove, and the charger assembly may include a detent arranged to engage the annular groove when the tip is disposed in the cavity of the charger assembly. The annular groove may be formed in the annular charging contact. Further, the detent may be resilient. The tip and the cavity may comprise magnets arranged to secure the forward portion of the shell with the cavity. The battery, the charging circuit, and the cartomizer may be disposed in the shell, and the switch assembly may comprise a pressure sensor disposed in the air flow path.

[0012] In still other preferred forms, the shell may include a light disposed adjacent the tip and the light may be visible at or through an area surrounding the center charging contact. The charger assembly may include a light arranged to indicate the battery is charging. Any one or more of the lights may be an LED.

[0013] In preferred method forms, the tip and the charger assembly may be provided with a detent mechanism, and the detent mechanism is engaged when placing the tip in the charger assembly. The tip and the cavity may be provided with cooperating magnets arranged to releasably secure the forward portion of the shell in the cavity.

[0014] In additional preferred method forms, the mouthpiece may be arranged to be removable from the shell, and the tip can be inserted into the charger assembly with the mouthpiece attached to the shell. An air flow path may be provided from the shell, through the cartomizer, and to an aperture adjacent a rearward portion of the mouthpiece. The cartomizer may be placed in the mouthpiece, and the cartomizer may be arranged to receive power from the battery via the switch assembly.

[0015] In further preferred method forms, a forward portion of the mouthpiece may be provided with an inner contact and an outer contact isolated from one another and electrically coupled to the cartomizer, and a rearward portion of the shell may be provided with an inner contact and an outer contact electrically isolated from one another and electrically coupled to the switch assembly. The various contacts are arranged to bring the inner and outer contacts of the mouthpiece and the shell, respectively, into contact with one another upon attaching the mouthpiece to the shell. The air flow path may be routed through the inner contact of the mouthpiece and the inner contact of the shell.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Figure 1A is a perspective view of a tip charging electronic cigarette and charging system assembled in accordance with the teachings of a disclosed example of the present invention and showing the tip of the electronic cigarette inserted into the charger assembly.

[0017] Figure 1B is an elevational view of an electronic cigarette and charging assembly of Figure 1A and showing the front or tip of the electronic cigarette in position for insertion into the charger assembly.

[0018] Figure 2 is an enlarged cross-sectional view, partly exploded, of the electronic cigarette shown in Figure 1A and 1B and illustrating the mouthpiece detached from the shell.

[0019] Figure 3 is an enlarged fragmentary exploded view in perspective showing the forward portion of the shell terminating in the tip of the electronic cigarette.

[0020] Figure 4 is an enlarged fragmentary exploded view in perspective showing the electrical contacts, the air flow path, and the switch assembly, all which are disposed adjacent the rearward end of the shell.

[0021] Figure 5 is an enlarged fragmentary view in perspective showing the forward end of the switch assembly and illustrating various connecting wires that extend into the switch assembly.

[0022] Figure 6 is an enlarged perspective view of the mouthpiece with portions of the mouthpiece cutaway to reveal the cartomizer.

- [0023] Figure 7 is an enlarged fragmentary perspective view of the front and of the mouthpiece and showing the electrical contacts and a portion of the air flow path.
- [0024] Figure 8 is a schematic diagram of an exemplary circuit for controlling activation and/or charging of the electronic cigarette.
- [0025] Figure 9 is a cross-sectional view in perspective of the charger assembly.
- [0026] Figure 10 is an enlarged fragmentary cross-sectional view of one exemplary retention mechanism in the form of a detent disposed inside the charger assembly.
- [0027] Figure 11 is an enlarged fragmentary cross-sectional view of another exemplary retention mechanism in the form of one or more magnets disposed inside the charger assembly.
- [0028] Figure 12 is an enlarged fragmentary view in perspective showing the charger assembly connected via a USB connector to a USB port providing a power source for charging the battery.

DETAILED DESCRIPTION

[0029] Although the following text sets forth a detailed description of one or more exemplary embodiments of the invention, it should be understood that the legal scope of the invention is defined by the words of the claims set forth at the end of this patent. The following detailed description is to be construed as exemplary only and does not describe every possible embodiment of the invention, as describing every possible embodiment would be impractical, if not impossible. Numerous alternative embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, and such alternative embodiments would still fall within the scope of the claims defining the invention.

Referring now to the drawings, Figures 1A and 1B illustrate a tip charging electronic cigarette system which is generally referred to by the reference numeral 10. The electronic cigarette system 10 includes a cigarette body 12 and a charger assembly 14. The cigarette body 12 includes a shell 16 and a mouthpiece 18, which are preferably removably coupled or joined to one another using a threaded connection as will be explained in greater detail below, although other connections may prove suitable. The shell 16 includes a forward portion 20 (obscured in Figure 1A but visible in Figure 1B), and a rearward portion 22. Similarly, the mouthpiece 18 includes a forward portion 24 and a rearward portion 26. As shown in Figure 1A, the forward portion 20 of the shell 16 terminates in a tip 28 (also obscured in Figure 1A but visible in Figure 1B). The tip 28 is shown in greater detail in Figures 2 and 3, and is described in greater detail below.

As shown in greater detail in Figure 2, the forward portion 24 of the mouthpiece 18 is removably coupled or otherwise removably attached or attachable to the rearward portion 22 of the shell 16. The cigarette body 12 includes a battery 30, a charging circuit 32 which is electrically connected or otherwise suitably operatively coupled to the battery 30, and a cartomizer 34 which is electrically connected or otherwise operatively coupled to a switch assembly 36. The charging circuit 32 and the switch assembly 36 are described in greater detail below with respect to Figure 8. The cigarette body 12 further includes a center charging contact 38 disposed adjacent the tip 28, and also includes an annular charging contact 40 also disposed adjacent the tip 28. The central nature of the center charging contact 38, as well as the annular nature of the annular charging contact 40, can be seen to advantage in Figure 3.

Referring still to Figure 2, the center charging contact 38 and the annular charging contact 40 are electrically connected or otherwise operatively coupled to the charging circuit 32. The charger assembly 14 is arranged for connection to a power source 42 (one exemplary power source 42 is shown in Figure 12), and the charger assembly 14 includes a housing 15 forming a cavity 44 which is sized and positioned to receive the forward portion 20 of the shell 16. The charger assembly also preferably includes a removable cap 15a. As shown in Figure 10, the charger assembly 14 includes a first electrical contact 46 and a second electrical contact 48, with the first and second electrical contacts 46 and 48 preferably being disposed within the cavity 44. The first electrical contact 46 is positioned within the cavity 44 so as to make an electrical connection with the center charging contact 38, while the second electrical contact 48 is positioned within the cavity 44 so as to make an electrical connection with the annular charging contact 40, when the tip 28 of the shell 16 is inserted into the cavity 44 of the charger assembly 14, to thereby permit charging of the battery when the tip is disposed in the cavity of the charger assembly and the charger assembly is connected to the power source 42.

[0030] Referring again to Figure 2, the shell 16 is shown in greater detail. The shell 16 may be constructed from a cylinder 50 having a forward end 50a and a rearward end 50b. The cylinder 50 may be constructed of metal, such as aluminum, or from any other suitable material. At the forward end 50a of the cylinder 50, the center charging contact 38 is carried by an insert 52, and the insert 52 is sized to fit within the annular charging contact 40. The insert 52 is electrically nonconductive, such that the center charging contact 38 and the annular charging contact 40 are electrically insulated from one another. In the example shown, the annular charging contact 40 is formed by a metal ring 54 (shown in greater detail in Figure 3), which is sized to be received and suitably secured within the end 50a of the cylinder 50. The shell 16 includes an outer electrical contact 56 disposed adjacent the

rearward end 50b, and also includes an inner electrical contact 58 disposed adjacent the rearward end 50b. The outer and inner electrical contacts 56 and 58 are electrically isolated from one another by an insulator 60. The outer electrical contact 56 includes an end 62a sized for insertion within the end 50b of the cylinder 50, and also includes a threaded portion 62b which, in the disclosed example, protrudes from the cylinder 50.

[0031] The battery 30 and a circuit module 64 are disposed within the cylinder 50. In the disclosed example, the circuit module 64 includes the charging circuit 32 and the switch assembly 36, both of which are obscured in Figure 2 but shown in detail in Figure 8. Alternatively, the charging circuit 32 and the switch assembly 36 may be disposed within the cigarette body 12 in any suitable fashion, and may be disposed separately within the shell 16 without the use of the circuit module 64. A light 66, which may be an LED or any other suitable light source, is disposed within the cylinder 50 toward the end 50a, and preferably is disposed behind the insert 52. Still preferably, the insert 52 is sufficiently transparent or translucent to allow the light 66 to be visible through the insert 52 when the light 66 is activated.

[0032] An air flow path 68 extends through the cigarette body 12. The air flow path 68 enters the shell 16 and hence the cigarette body 12 at any suitable location, extends to the cartomizer 34, and eventually exits the cigarette body 12 via an aperture 70 in the mouthpiece 18. In the example shown, the air flow path 68 includes at least one inlet aperture 72 which, in the disclosed example, is formed through the metal ring 54 that forms the annular charging contact 40. Alternatively, the inlet aperture 72 may be formed in any suitable location. A portion 68a (shown schematically in Figure 2) of the air flow path 68 extends into and through the tip 28. Another portion 68b of the air flow path 68 extends through a designated path or any available space within the cylinder 50 to extend past the battery 30, through another portion 68c through the circuit module 64 (shown schematically in Figure 2), and to an aperture 74 leading out of the shell 16. The flow path 68 continues from the aperture 74 into an inlet aperture 76 in the mouthpiece 18, or the flow path 68 passes through the cartomizer 34 and exits the exit aperture 70 (visible in Figures 2 and 6) in the mouthpiece 18. Those of skill in the art will understand that the air flow path 68 may be formed variety of ways, as long as air is suitably routed past/through the cartomizer 34. In the example shown, the aperture 74 exiting the shell 16 is formed by or through the inner electrical contact 58, while the aperture 76 is formed by or through the inner electrical contact of the mouthpiece 18 as will be shown and described in greater detail below.

[0033] As is also shown in Figure 2, the center charging contact 38 is electrically connected to the circuit module 64 by a connector 65, while the annular charging contact 40 is connected to the circuit module 64 via the cylinder 50 and a connector 67. The light 66 is

connected to the circuit module 64 by a connector 69 while the battery 30 is connected to the circuit module 64 via a pair of connectors 71 and 73. The outer electrical contact 56 is connected to the circuit module 64 via a connector 75, while the inner electrical contact is connected to the circuit module 64 by a connector 77. The connectors 67 and 75 act as grounds to the shell 50. Additional details of the circuitry will be explained below with respect to Figure 8.

[0034] Referring now to Figure 3, in the example shown therein the metal ring 54 that forms the annular charging contact 40 preferably includes an annular groove 80. The annular groove 80 engages a cooperating retention mechanism 81 which, in the example of Figures 9 and 10 takes the form of a detent 81a disposed inside the charger assembly 14 as will be explained below. Preferably the detent is resilient or spring loaded so as to provide a positive connection when the tip 28 of the cigarette body is inserted into the charger assembly 14. An alternative retention mechanism 181 is shown in Figure 11 and will be discussed in greater detail below, and may be magnetic and may include one or more magnets carried by the tip 28 and/or the charger assembly 14. Regardless of whether the tip 28 is retained in the charger by the retention mechanism 81 or 181, the tip 28 and the charger assembly 14 preferably cooperate to retain the charging contacts 38 and 40 of the tip 28 in contact with the contacts 46 and 48, respectively, of the charger assembly 14, such that the power is made available from the power source 42 to charge the battery 30.

[0035] Figure 4 shows, in partly exploded form, the rearward portion 22 of the shell 16 (including a cutaway portion of the cylinder 50 shown slightly expanded), the outer electrical contact 56, the inner electrical contact 58, the circuit module 64, and the aperture 74 forming a portion of the flow path 68. In the example shown, the outer electrical contact 56 includes a threaded connection 82, which cooperates with a threaded connection 84 carried by the forward portion 24 of the mouthpiece 18 (the threaded connection is not shown in Figure 4, but is visible in Figures 2, 6 and 7). The circuit module 64 includes a forward end 64a and a rearward end 64b. In the arrangement shown, the rearward end 64b of the circuit module 64 includes a protrusion 86 which is sized to engage a recess 88 in the forward end 62a of the outer electrical contact 56, such that the circuit module 64 and the outer electrical contact 56 are nested together. Alternatively, the circuit module 64 may be disposed within the body 12 in any desirable location. In the disclosed example, a portion of the air flow path 68 extends through both the circuit module 64 and the inner electrical contact 58.

[0036] Figure 5 shows the forward end 64a of the circuit module 64 in greater detail. The forward end 64a of the circuit module 64 preferably includes one or more apertures 90. In accordance with the disclosed example, one or more of the apertures 90 form all or a portion of the portion 68c of the air flow path 68 that flows through the circuit module 64.

Alternatively, the portion 68c of the air flow path 68 may be routed around the circuit module 64 in any suitable fashion. One or more of the apertures 90 also may be used to route the appropriate connectors 65, 69, 71 and 73 into the circuit module 64. In the example shown, the connector 65 extends through an aperture 90a to the circuit module 64, the connector 69 extends through an aperture 90b to the circuit module 64, the connector 71 extends through an aperture 90c to the circuit module 64, and the connector 73 extends through an aperture 90d to the circuit module 64. Alternatively, the connectors 65, 69, 71 and 73 may be routed to their appropriate circuits or components in any suitable fashion.

[0037] Figures 6 and 7 show the mouthpiece 18 in greater detail. The mouthpiece 18 includes a forward end 92a and a rearward end 92b. As outlined above, in the example shown the cartomizer 34 is disposed within the mouthpiece 18. Other locations for the cartomizer 34 may prove suitable. The cartomizer 34 may be conventional, and includes a cylinder (reservoir) 94, preferably surrounded by wadding, and a heating element 99. The heating element 99 receives power from the battery 30 via a suitable circuit 102 (discussed in greater detail below with respect to Figure 8), and the heating element 99 generates heat to vaporize a propylene glycol- or glycerin-based liquid solution into an aerosol mist. The liquid solution preferably includes nicotine. Other carrier solutions may be contemplated, and other any other forms for the cartomizer may prove suitable.

[0038] The mouthpiece 18 may be constructed from a cylinder 94 forming the forward end 92a and the rearward end 92b. The cylinder 94 may be constructed of metal, such as aluminum, or from any other suitable material. The mouthpiece 18 includes a center contact 96 adjacent the forward end 92a of the cylinder 94. In the example, shown, the center contact includes the aperture 76. The aperture 76 is in flow communication with the aperture 70 at the rearward end 92b in any suitable manner, and thus forms a portion of the air flow path 68. In the disclosed example, the cylinder 94 itself forms an outer contact, and the inner and outer contacts are electrically isolated from one another using any suitable insulator 100. The threaded connection 84 is formed adjacent the forward end 92a in any suitable manner. In the example shown, the forward end 92a and/or the threaded connection 84 form the outer contact.

[0039] Fig. 8 illustrates an exemplary circuit 102 incorporating the battery 30, the charging circuit 32, the cartomizer 34, the switch assembly 36, and the light 66 for use in the tip charging electronic cigarette system 10. In the disclosed example, the charging circuit 32 includes a power regulator 104 for regulating the amount of power that flows to the battery 30. The power regulator 104 is connected to the center charging contact 38 by the connection 65, and the power regulator 104 in turn is connected to the battery 30 by connections 65a and 65b. The circuit 102 includes the switch assembly 36 which is

responsive to air pressure or air flow along or through the air flow path 68. The switch assembly 36 may be any one of a number of air pressure or air flow switches including, but not limited to, a vane switch. The light 66 is coupled to the battery 30 via the switch assembly 36, which ultimately activates the circuit 102 when air or air pressure is sensed at the switch assembly. Preferably, the pressure is sensed by a pressure sensor disposed in the air flow path. Ultimately, power is routed to the cartomizer 34 and hence to the heating element 99 via suitable connections 104 and 106. The connection 104 is formed by contact between the outer contact 56 carried by the rearward end 50b of the cylinder 50/shell 16 and the outer contact carried by the mouthpiece 18. The connection 106 is formed by contact between the inner contact 58 carried by the rearward end 50b of the cylinder 50/shell 16 and the contact 96 carried by or adjacent the forward end 92a of the mouthpiece 18.

[0040] The electrical components shown in Figure 8 may be suitably disposed within the body 12 and/or the shell 16 in any suitable manner. In the disclosed example, the cartomizer 34 that is disposed in the mouthpiece 18. Other configurations may be contemplated. Also, those of skill in the art will readily understand that the circuit 102 may include or take the form of any other suitable circuit that, for example, may control overcharging of the battery 30 or that may prevent damage to the circuit 102 should a wrong polarity voltage be applied at the charging contact 38.

[0041] Referring now to Figure 9 the charger assembly 14 is shown in greater detail. The charger assembly 14 includes a charging pin 108 disposed so as to protrude through a panel 110 and into cavity 44. In the example shown, the charging pin 108 is coupled to a spring 112. The charging pin 108 is also electrically coupled to a suitable pin or connector disposed inside a USB connector 114. The cavity 44 includes another connector 116, which also is electrically coupled to a suitable pin or connector disposed inside the USB connector 114. The connection between the charging pin 108, and suitable pin or connector of the USB connector 114, as well as the connection between the connector 116 and the suitable pin or connector of the USB connector 114 are not shown, but both would be conventional and readily achievable by those of skill in the art. The charger assembly 14 preferably includes a light 116 visible through an aperture 118 in the charger assembly 14. The light 116 preferably is energized when the USB connector 114 is connected to a suitable power source 42 as shown in Figure 12.

[0042] Referring now to Figure 10, the retention mechanism 81 may be constructed from the detent 81a, which is positioned within the cavity 44 of the charger assembly 14 so as to engage the annular groove 80, which forms, the outer charging contact 40 adjacent the tip 28 of the electronic cigarette 12. As the detent 81a is preferably resilient, the user can push the tip 28 into the cavity 44 until the tip 28 forces the detent 81a over the end of the

electronic cigarette 12 until the detent 81a falls into the annular groove 80. The detent 81a may form the contact 48. Alternatively, the contact 48 and the detent 81a may be separate. Consequently, the charging contact 38 is in contact with the charging pin 108, while the outer charging contact 40 is in contact with the contact 48/detent 81a. As both the charging pin 108 and the contact 48/detent 81a are suitably coupled to the USB connector 114, power from the power source 42 is routed to the appropriate contacts, thus allowing power to be routed to the battery via the circuit 102 as outlined above.

[0043] Referring now to Figure 11, the retention mechanism 181 may be constructed from suitable magnetic components. For example, the retention mechanism 181 may include a magnet 181a carried adjacent the tip 28 of the electronic cigarette 12, and a cooperating magnet 181b carried within the cavity 44 of the charger assembly 14. The magnet 181b may form the contact 48, and thus may be suitably connected to the USB connector 114. Alternatively, the contact 48 and the magnet 181b may be separate, in which case the contact 48 is connected to the USB connector 114. Those of skill in the art may contemplate additional alternatives, such as by providing a magnet within the charger assembly 14 in conjunction with a steel component adjacent the tip 28 of the electronic cigarette 12, or the magnet 181a in conjunction with a steel portion disposed within the cavity 44 of the charger assembly 14. Still other alternatives may be contemplated, as long as there is sufficient magnetic force so as to suitably retain electronic cigarette 12 within the cavity 44, with electrical contact suitable to allow power to be routed to the battery via the circuit 102 as outlined above.

[0044] In operation, the user (not shown) places the mouthpiece 18 of the electronic cigarette 12 into his or her mouth and draws air through the air flow path 68. The resultant changes in airflow or air pressure causes the switch assembly 36 to close, thus energizing the heating element 99 of the cartomizer 34. Consequently, the heating element 99 vaporizes a portion of the carrier liquid disposed within the cartomizer 34, allowing the user to draw the vapor through the aperture 70. When the switch assembly 36 is closed and the circuit 102 is energized, power from the battery 30 is also routed to the light 66, causing the light to energize. Because the inserts 52 is suitably transparent or translucent, the light 66 is visible from the end of the electronic cigarette 12, thus visually simulating a more traditional smoking device in a pleasing manner.

[0045] When the power level in the battery 30 is depleted or undesirably diminished, the user may insert the tip 28 of the electronic cigarette 12 into the cavity 44 of the charger assembly 14 in the manner shown in either Figure 10 or Figure 11. In either form, the center charging contact 38 makes contact with contact 46/charging pin 108, while the outer contact 40 makes contact with the contact 48/detent 81a (or the contact 181b), thus charging the

battery. As shown in Figure 12, the charger assembly 14 may be coupled to a suitable power source 42, such as a computer, a 12V power source via a suitable adapter, or to any other suitable power source.

[0046] While certain representative embodiments and details have been shown for purposes of illustrating the invention, it will be apparent to those skilled in the art that various changes in the methods and apparatus disclosed herein may be made without departing from the scope of the invention.

CLAIMS

1. A tip charging electronic cigarette system, the system comprising:

a cigarette body, the cigarette body including a shell and a mouthpiece, each of the shell and the mouthpiece having a forward portion and a rearward portion, the forward portion of the shell terminating in a tip, the forward portion of the mouthpiece removably coupled to the rearward portion of the shell;

the cigarette body further including a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly;

a center charging contact disposed adjacent the tip;

an annular charging contact disposed adjacent the tip;

the center charging contact and the annular charging contact operatively coupled to the charging circuit; and

a charger assembly arranged for connection to a power source, the charger assembly having a cavity arranged to receive the forward portion of the shell, the charger assembly further including first and second electrical contacts disposed within the cavity, the first electrical contact arranged to make electrical connection with the center charging contact and the second electrical contact arranged to make electrical connection with the annular charging contact to permit charging of the battery when the tip is disposed in the cavity of the charger assembly.

2. The electronic cigarette system of claim 1, wherein the cigarette body includes an air flow path extending from the shell, through the cartomizer, and to an aperture adjacent the rearward portion of the mouthpiece, and wherein the cartomizer is disposed in the mouthpiece and is arranged to receive power from the battery via the switch assembly.

3. The electronic cigarette system of claim 2, wherein the forward portion of the mouthpiece includes an inner contact and an outer contact, the inner and outer contact of the mouthpiece electrically isolated from one another and electrically coupled to the cartomizer, and wherein the rearward portion of the shell includes an inner contact and an outer contact electrically isolated from one another and electrically coupled to the switch assembly, the inner contacts of the mouthpiece and the shell and the outer contacts of the mouthpiece and the shell respectively arranged to contact one another when the mouthpiece is attached to the shell.

4. The electronic cigarette assembly of claim 3, wherein the air flow path extends through inner contact of the mouthpiece and the inner contact of the rearward portion of the shell.
5. The electronic cigarette system of claim 1, wherein the charger assembly includes a USB connector.
6. The electronic cigarette system of claim 1, wherein the first electrical contact of the charger assembly includes a spring-loaded pin.
7. The electronic cigarette system of claim 1, wherein the forward portion of the shell includes an annular groove, and wherein the charger assembly includes a detent arranged to engage the annular groove when the tip is disposed in the cavity of the charger assembly.
8. The electronic cigarette assembly of claim 7, wherein the annular groove is formed in the annular charging contact.
9. The electronic cigarette assembly of claim 7, wherein the detent is resilient.
10. The electronic cigarette assembly of claim 1, wherein the tip and the cavity comprise magnets arranged to secure the forward portion of the shell with the cavity.
11. The electronic cigarette assembly of claim 1, wherein the battery, the charging circuit, and the cartomizer are disposed in the shell, and wherein the switch assembly comprises a pressure sensor disposed in the air flow path.
12. The electronic cigarette assembly of claim 1, wherein the shell includes a light disposed adjacent the tip, the light visible at an area surrounding the center charging contact.
13. The electronic cigarette assembly of claim 12, wherein the light is an LED.

14. The electronic cigarette assembly of claim 1, wherein the charger assembly includes a light arranged to indicate the battery is charging.

15. A method of charging an electronic cigarette, the comprising:

providing a cigarette body, the cigarette body including a shell, a mouthpiece, a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly;

providing a forward portion of the shell with a tip having a center charging contact and an annular charging contact, both the center and annular charging contacts electrically coupled to the charging circuit and disposed adjacent the tip;

providing a charger assembly arranged for connection to a power source, the charger assembly having a cavity arranged to receive the forward portion of the shell, the charger assembly including a first electrical contact disposed within the cavity and positioned to engage the center charging contact, the charger assembly further including a second electrical contact disposed within the cavity and positioned to engage the annular charging contact;

coupling the charger assembly to a power source; and

inserting the forward portion of the shell having the tip into the cavity of the charger assembly to bring the center and annular charging contacts of the tip into engagement with the first and second electrical contacts, respectively, of the charger assembly to charge the battery.

16. The method of claim 15, including providing the tip and the charger assembly with a detent mechanism, and engaging the detent mechanism when placing the tip in the charger assembly.

17. The method of claim 15, including providing cooperating magnets adjacent the tip and the cavity and arranged to releasably secure the forward portion of the shell in the cavity.

18. The method of claim 15, including arranging the mouthpiece to be removable from the shell, and inserting the tip into the charger assembly with the mouthpiece attached to the shell.

19. The method of claim 15, including providing an air flow path from the shell, through the cartomizer, and to an aperture adjacent a rearward portion of the mouthpiece, providing the cartomizer in the mouthpiece, and arranging the cartomizer to receive power from the battery via the switch assembly.

20. The method of claim 15, including providing a forward portion of the mouthpiece with an inner contact and an outer contact isolated from one another and electrically coupled to the cartomizer, providing a rearward portion of the shell with an inner contact and an outer contact electrically isolated from one another and electrically coupled to the switch assembly, and arranging the inner and outer contacts of the mouthpiece and the shell to contact one another upon attaching the mouthpiece to the shell.

21. The method of claim 20, including routing the air flow path through the inner contact of the mouthpiece and the inner contact of the shell.

22. A tip charging electronic cigarette comprising:

a cigarette body, the cigarette body including a shell and a mouthpiece, the shell having a forward portion terminating in a tip;

the cigarette body further including a battery, a charging circuit operatively coupled to the battery, and a cartomizer operatively coupled to a switch assembly;

a center charging contact disposed adjacent the tip;

an annular charging contact disposed adjacent the tip;

the center charging contact and the annular charging contact operatively coupled to the charging circuit;

the center charging contact and the annular charging contact arranged for connection to cooperating electrical contacts of a charger assembly; and

wherein the battery is arranged to be charged upon engaging the tip with the charger assembly.

23. The tip charging electronic cigarette of claim 22, wherein the forward portion of the mouthpiece is removably coupled to the rearward portion of the shell, wherein the cigarette body includes an air flow path extending from the shell, through the cartomizer, and to an aperture adjacent the rearward portion of the mouthpiece, and wherein the cartomizer is disposed in the mouthpiece and is arranged to receive power from the battery via the switch assembly.

24. The tip charging electronic cigarette of claim 23, wherein the forward portion of the mouthpiece includes an inner contact and an outer contact, the inner and outer contact of the mouthpiece electrically isolated from one another and electrically coupled to the cartomizer, and wherein the rearward portion of the shell includes an inner contact and an outer contact electrically isolated from one another and electrically coupled to the switch assembly, the inner and outer contacts of the mouthpiece and the shell arranged to contact one another when the mouthpiece is attached to the shell.

25. The tip charging electronic cigarette of claim 24, wherein the air flow path extends through the inner contact of the mouthpiece and the inner contact of the rearward portion of the shell.

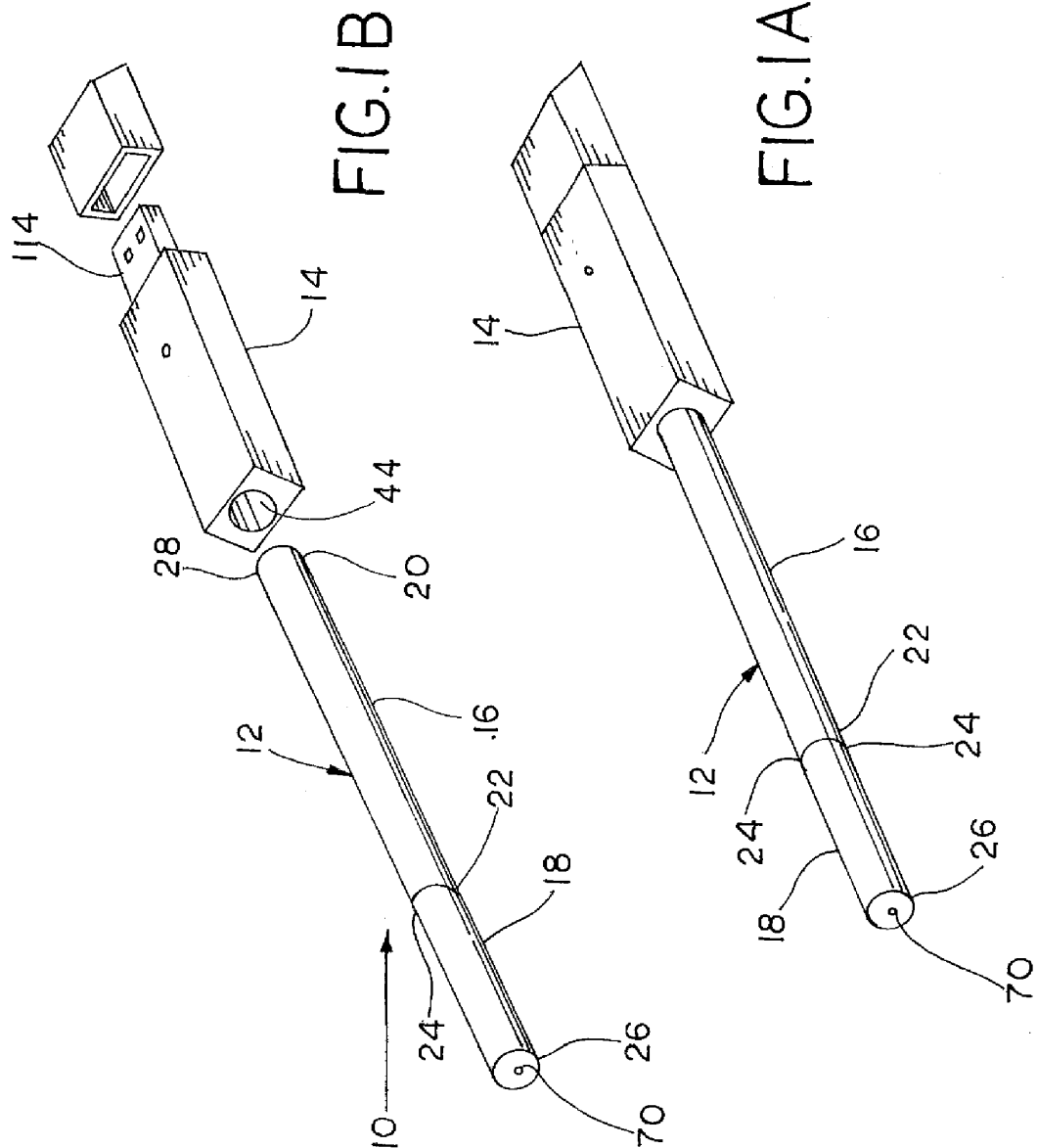
26. The tip charging electronic cigarette of claim 22, wherein the charging circuit is arranged to receive power via a USB connector.

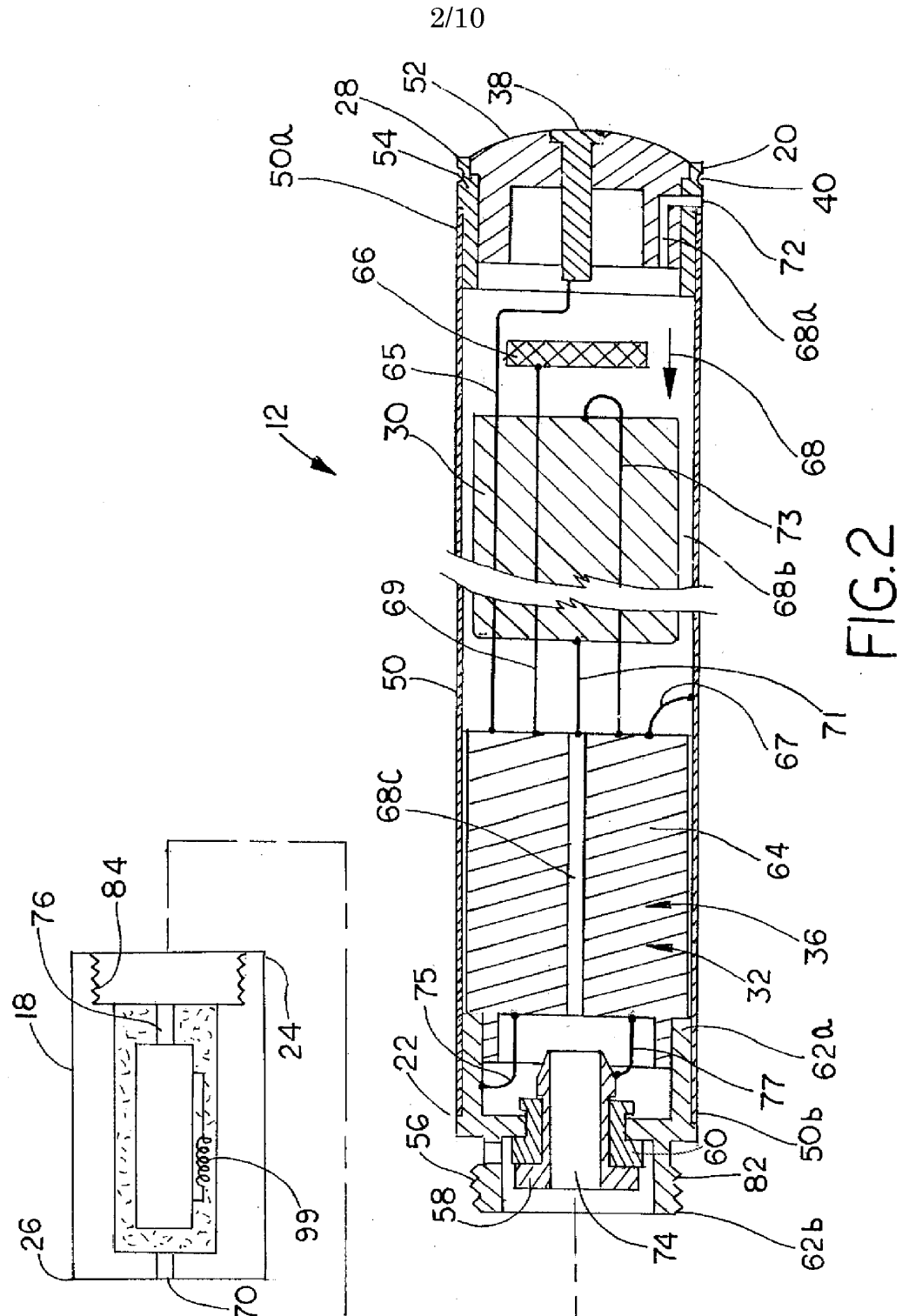
27. The tip charging electronic cigarette of claim 22, wherein the forward portion of the shell includes an annular groove, and wherein the annular groove is sized and positioned to be engaged by a detent carried by the charger assembly.

28. The tip charging electronic cigarette of claim 27, wherein the annular groove is formed in the annular charging contact.

29. The tip charging electronic cigarette of claim 22, wherein forward portion of the shell adjacent the tip includes a magnet arranged to interact with a magnet of the charging assembly.

30. The tip charging electronic cigarette of claim 22, wherein the battery, the charging circuit, and the cartomizer are disposed in the shell, and wherein the switch assembly comprises a pressure sensor disposed in the air flow path.





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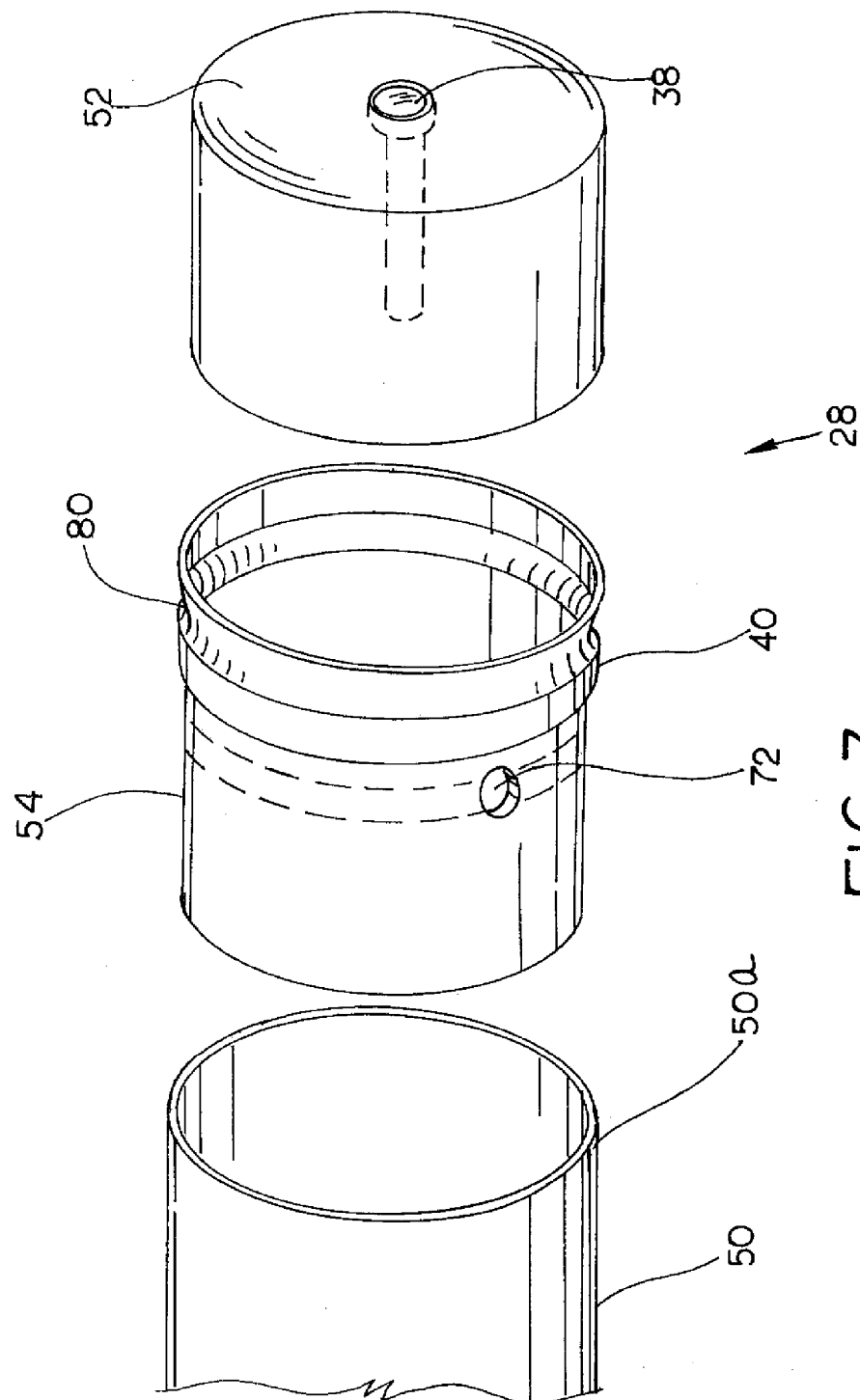


FIG. 3

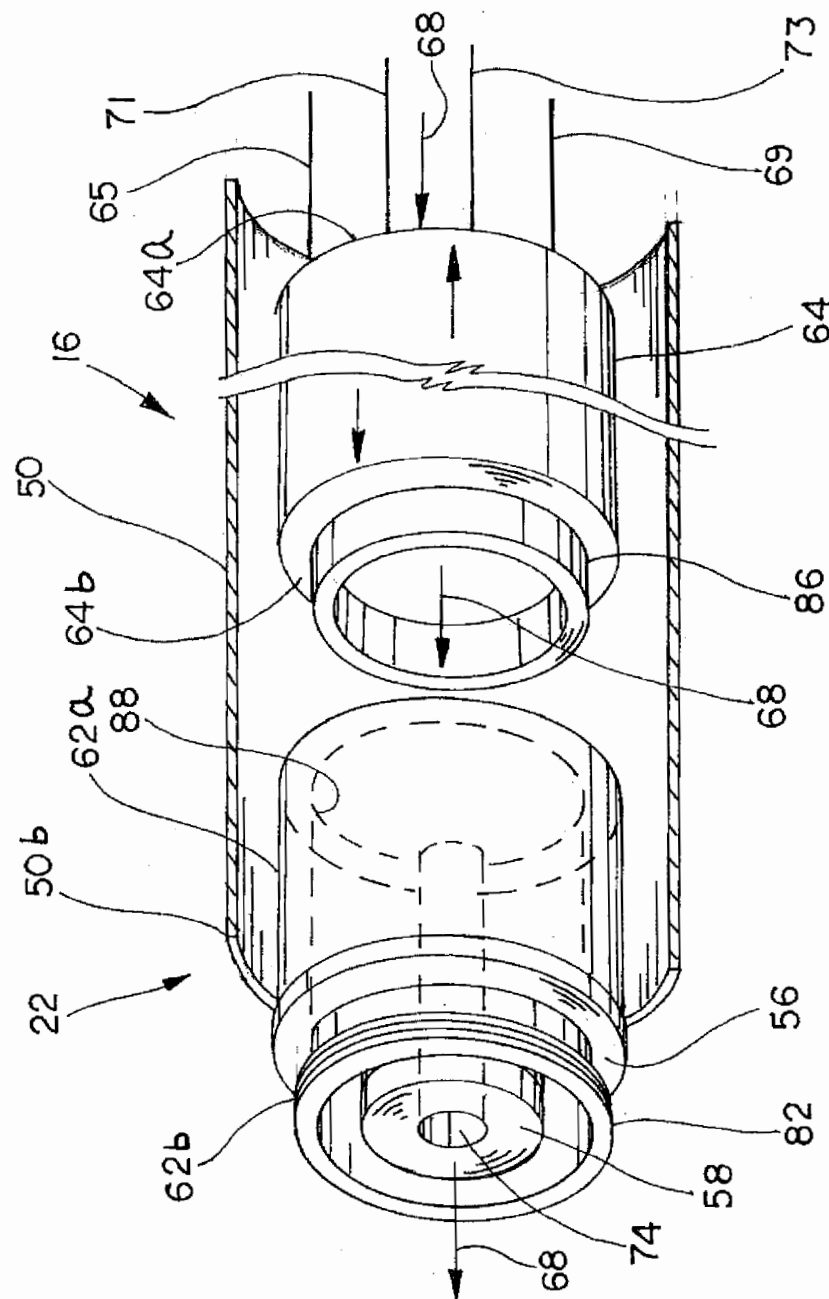


FIG. 4

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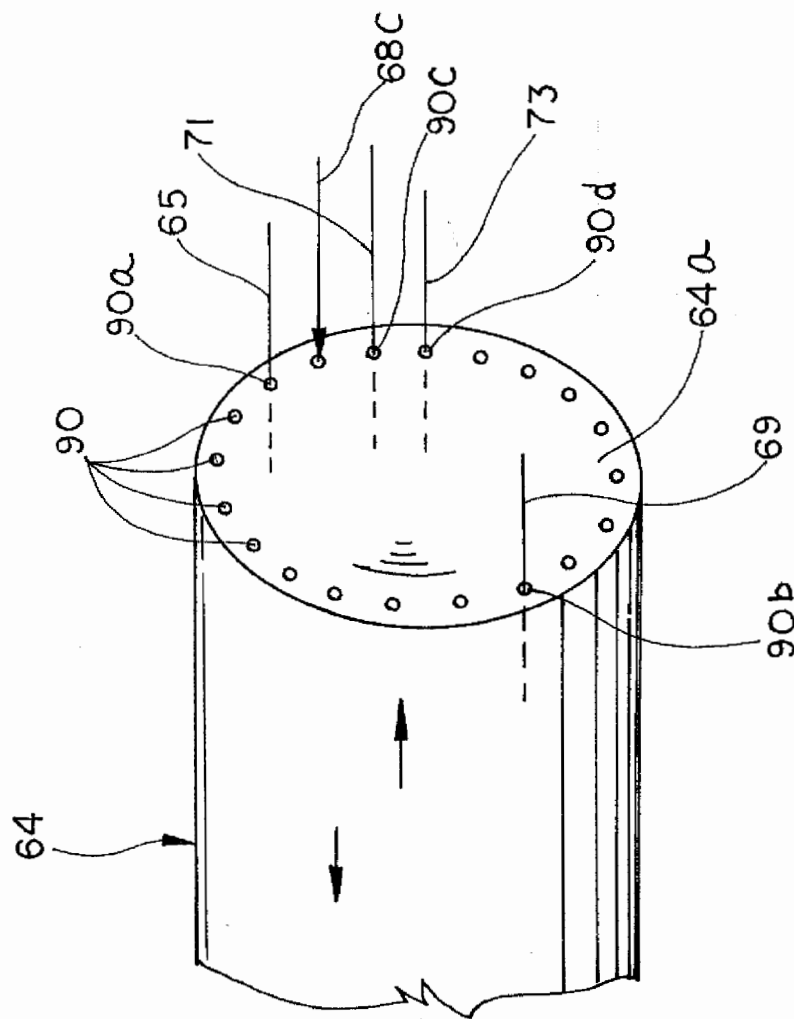
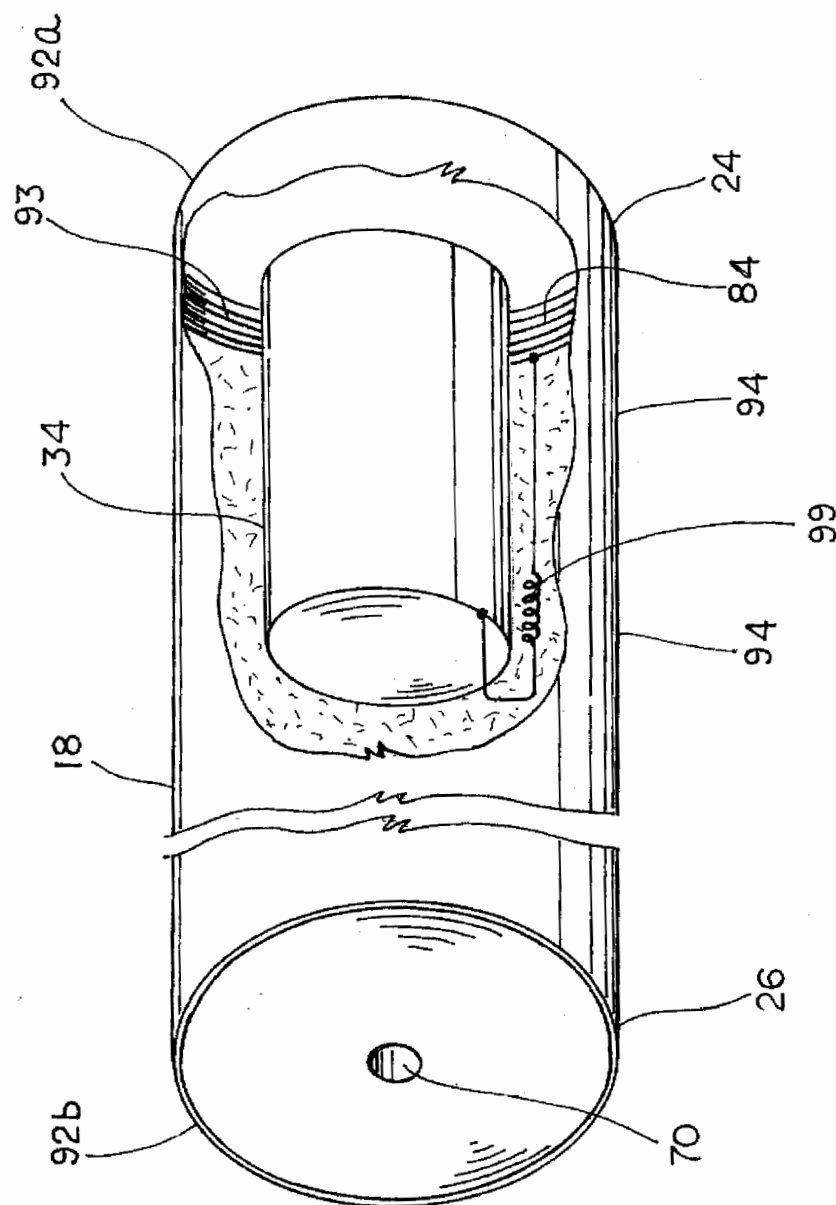


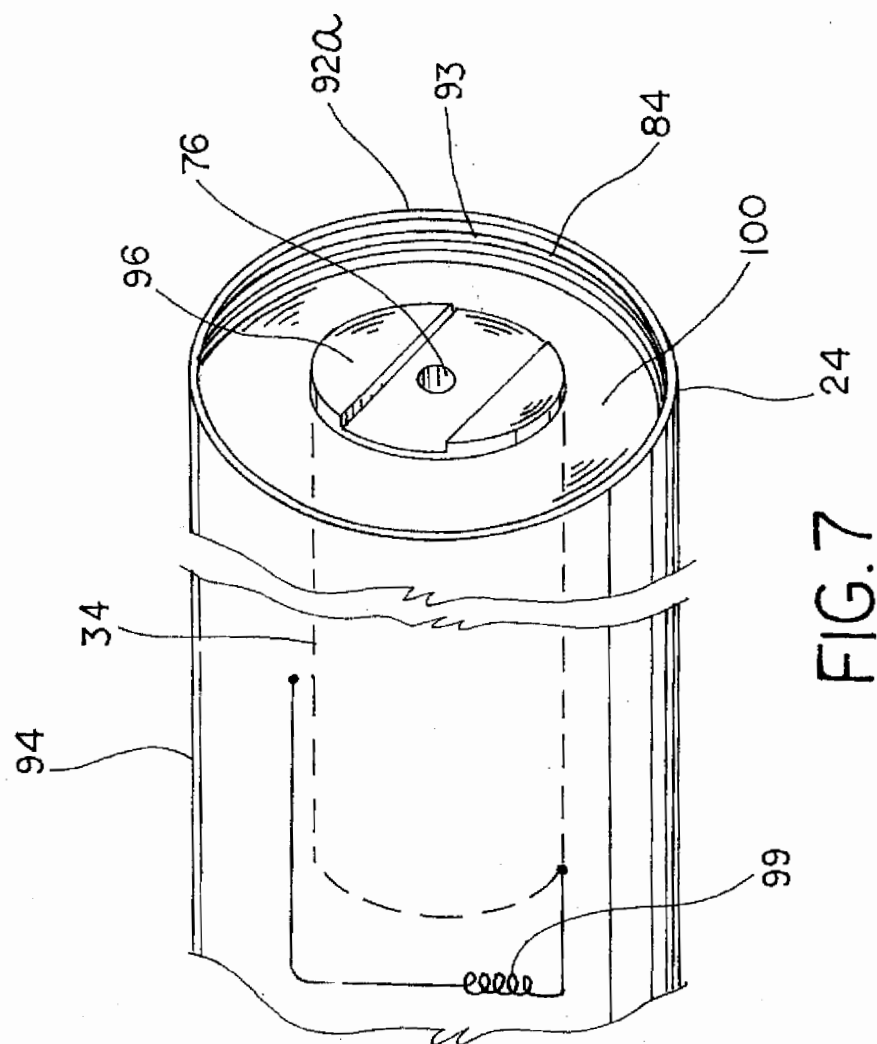
FIG. 5

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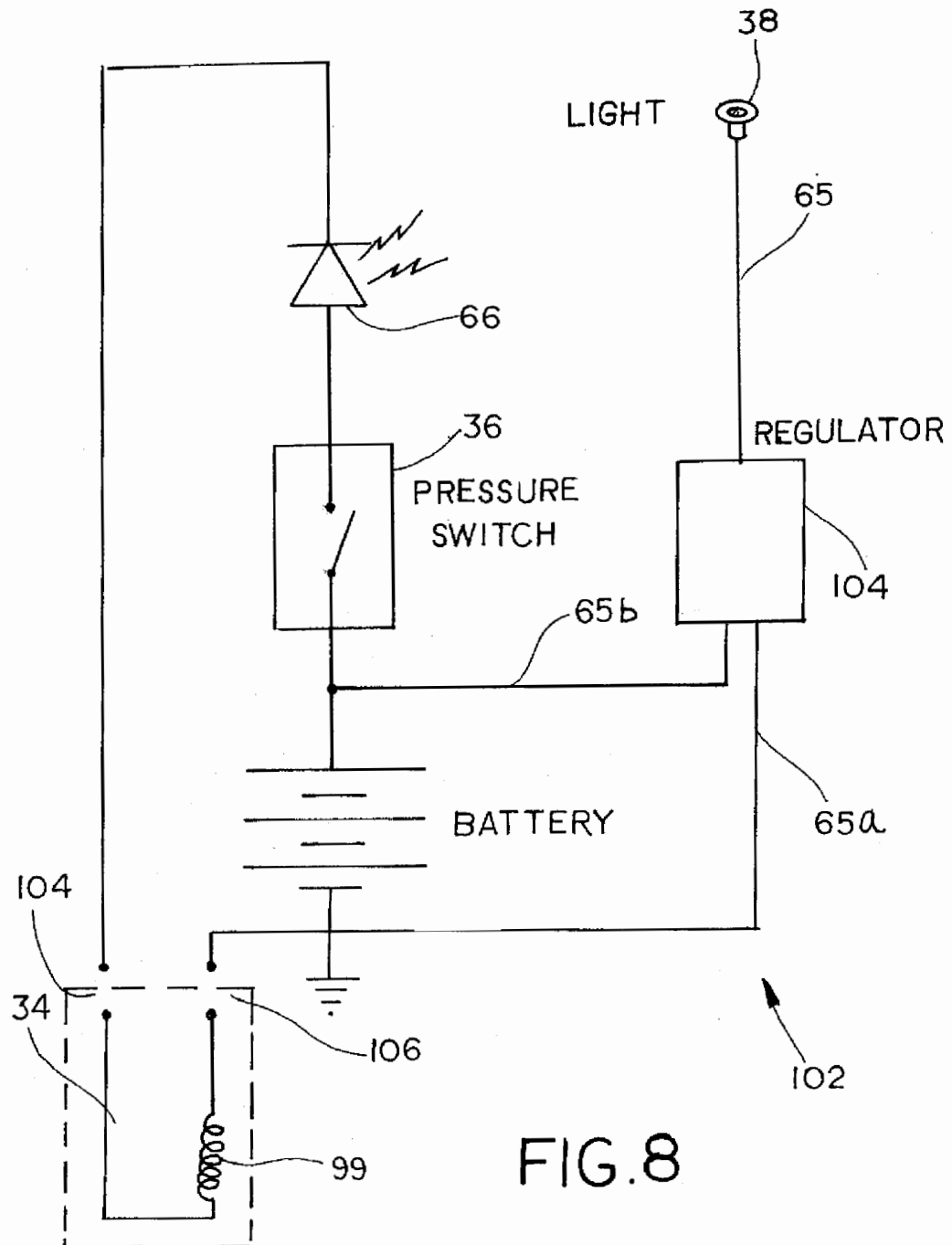


FIG. 8

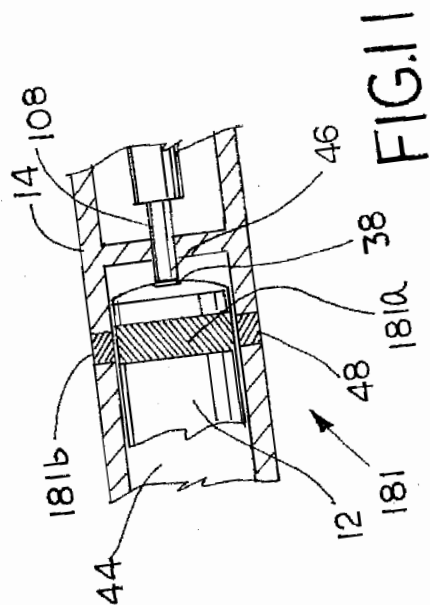


FIG. 11

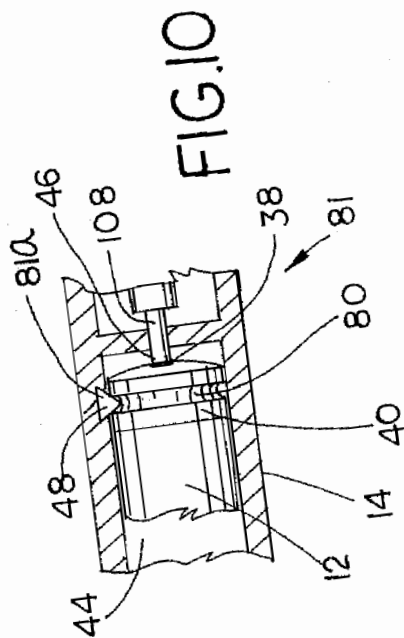


FIG. 10

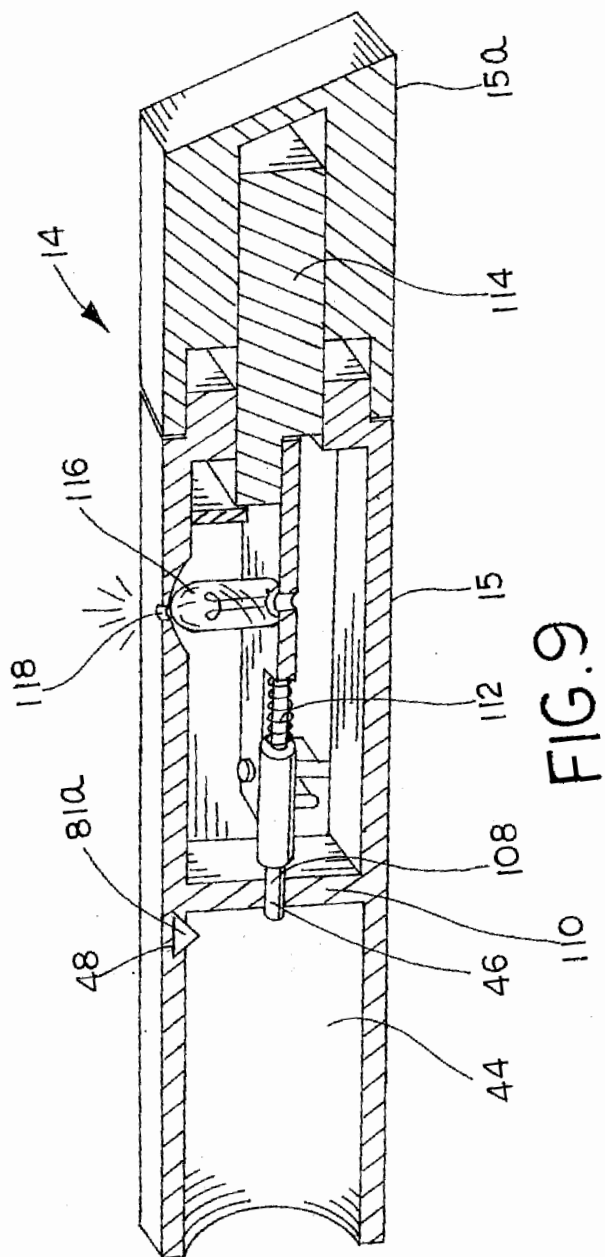


FIG. 9

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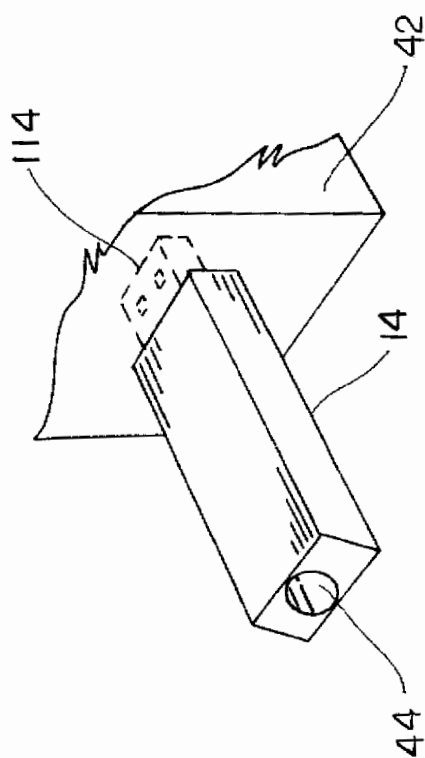


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2012/078542

A. CLASSIFICATION OF SUBJECT MATTER

A24F47/00(2006.01) i

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: A24F47/00

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)

WPI,EPODOC,CNKI,CNPAT: cigarette, charg???, battery, contact+, usb, connect+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN201393548Y(XIA, Haoran) 03 Feb. 2010(03.02.2010) the whole document	1-30
A	CN201515249U(NINGBO KANGSHENG ELECTRONIC SCI TECHNOLOGY) 23 Jun. 2010 (23.06.2010) the whole document	1-30
A	US2010/0031968A1(GAMUCCILTD) 11 Feb. 2010(11.02.2010) the whole document	1-30
A	JP2011-87569A(JBS KK) 06 May 2011(06.05.2011) the whole document	1-30
A	CN201352950Y(XIA, Haoran) 02 Dec.2009(02.12.2009) the whole document	1-30

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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“E” earlier application or patent but published on or after the international filing date	“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
“L” document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	“&”document member of the same patent family
“O” document referring to an oral disclosure, use, exhibition or other means	
“P” document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 01 Feb.2013(01.02.2013)	Date of mailing of the international search report 28 Mar. 2013 (28.03.2013)
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Information on patent family members

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PCT/CN2012/078542

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN201393548Y	03.02.2010	NONE	
CN201515249U	23.06.2010	NONE	
US2010/0031968A1	11.02.2010	GB2465247A	19.05.2010
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CN201352950Y	02.12.2009	NONE	

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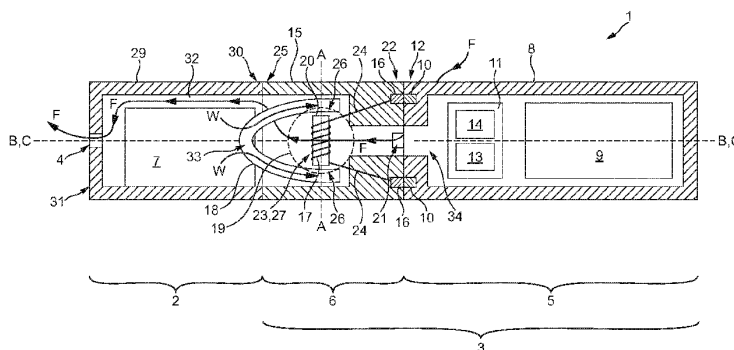


FIG. 2

(57) Abstract: An electronic vapour provision device (1) comprising a power cell (9, 54), a vaporiser (6, 52) and a liquid store (7, 51), where the vaporiser comprises a heating element (17, 68) and a heating element support (20, 67), wherein the liquid store comprises a porous material.

Electronic Vapour Provision Device

Technical Field

The specification relates to electronic vapour provision devices.

Background

5 Electronic vapour provision devices are typically cigarette-sized and typically function by allowing a user to inhale a nicotine vapour from a liquid store by applying a suction force to a mouthpiece. Some electronic vapour provision devices have an airflow sensor that activates when a user applies the suction force and causes a heater coil to heat up and vaporise the liquid. Electronic vapour provision devices include electronic
10 cigarettes.

Summary

In an embodiment there is provided an electronic vapour provision device comprising a power cell, a vaporiser and a liquid store, where the vaporiser comprises a heating element and a heating element support, wherein the liquid store comprises a porous
15 material. The heating element support may form part of the liquid store or may be the liquid store. Moreover, the heating element may be supported from its outside by the heating element support or the heating element may be supported from its inside by the heating element support.

One or more gaps may be provided between the heating element and the heating
20 element support.

In another embodiment there is provided a vaporiser for use in the electronic vapour provision device, comprising a heating element and a porous heating element support, wherein the heating element support is a liquid store.

In another embodiment there is provided a mouthpiece, including a heating element
25 and a porous heating element support, wherein the heating element support is a liquid store.

In another embodiment there is provided an electronic vapour provision device comprising a heating element for vaporising liquid; an air outlet for vaporised liquid from the heating element; and a porous heating element support, wherein the heating

element support is a store of liquid. The electronic vapour provision device may include a power cell for powering the heating element.

Brief Description of the Drawings

For a better understanding of the disclosure, and to show how example embodiments
5 may be carried into effect, reference will now be made to the accompanying drawings in which:

Figure 1 is a side perspective view of an electronic cigarette;

Figure 2 is a schematic sectional view of an electronic cigarette having a perpendicular coil;

10 Figure 3 is a side perspective view of a porous heating element support;

Figure 4 is a side perspective view of a porous heating element support and a coil;

Figure 5 is an end view of a porous heating element support and a coil;

Figure 6 is a schematic sectional view of an electronic cigarette having a parallel coil;

Figure 7 is a side perspective view of an outer porous heating element support;

15 Figure 8 is a side perspective view of an outer porous heating element support and a coil;

Figure 9 is an end view of an outer porous heating element support and a coil;

Figure 10 is an end view of a porous heating element support with channels, and a coil;

20 Figure 11 is an end view of a porous heating element support having an octagonal cross-sectional shape, and a coil;

Figure 12 is an end view of a porous heating element support having a four arm cross cross-sectional shape, and a coil;

Figure 13 is an end view of an outer porous heating element support and a coil;

Figure 14 is an end view of an outer porous heating element support and a coil; and

25 Figure 15 is an end view of an two part outer porous heating element support and a coil.

Detailed Description

In an embodiment there is provided an electronic vapour provision device comprising a power cell, a vaporiser and a liquid store, where the vaporiser comprises a heating element and a heating element support, wherein the liquid store comprises a porous material. The electronic vapour provision device may be an electronic cigarette. By having a liquid store comprising porous material, the liquid can be retained more efficiently, and also release and storage of the liquid is more controlled through the wicking action of the porous material.

The liquid store may comprise a solid porous material or a rigid porous material. For example, the liquid store may comprise a porous ceramic material. A solid porous material is advantageous since it is not open to deformation so the properties can be set and maintained. The shape can be defined at the manufacturing stage and this specific shape can be retained in the device to give consistency in device usage.

The liquid store may not comprise an outer liquid store container. Providing a solid porous material removes the need for an outer liquid store container and therefore gives a more efficient storage means.

The porous material may be optimized for liquid retention and wicking and/or for liquid glycerine retention and wicking. Moreover, the porous material may have pores of substantially equal size. The porous material may comprise pores distributed evenly throughout the material. Moreover, the porous material may be configured such that the majority of the material volume comprises open pores for liquid storage. The liquid store may be sealed on at least part of an outer surface region to inhibit porosity in that region.

The porous material may have smaller pores in a region next to the heating element and larger pores further from the heating element. The porous material may have a gradient of pore sizes ranging from smaller pores next to the heating element to larger pores further from the heating element.

The liquid store may be configured to wick liquid onto the heating element. The configuration of pores acts to determine the wicking effect of the storage medium, such that a more efficient means of transmission of liquid onto the heating element can be achieved.

The heating element support may form part of the liquid store, a separate additional liquid store or the entirety of the liquid store. By removing the requirement for a separate support, the number of components is reduced giving a simpler and cheaper device and enabling a larger liquid store to be used for increased capacity.

- 5 The heating element may be supported from its outside by the heating element support. Alternatively or additionally, the heating element may be supported from its inside by the heating element support.

One or more gaps may be provided between the heating element and the heating element support. Providing a gap between the heating element and the heating
10 element support allows liquid to be gathered and stored in the gap region for vaporisation. The gap can also act to wick liquid onto the heating element. Also, providing a gap between the heating element and support means that a greater surface area of the heating element is exposed thereby giving a greater surface area for heating and vaporisation.

- 15 The heating element may be a heating coil, such as a wire coil. The heating coil may be coiled so as to be supported along its length by the heating element support. Moreover, the turns of the heating coil may be supported by the heating element support. For example, the turns of the heating coil may be in contact with the heating element support. One or more gaps may be provided between the heating coil and the heating
20 element support. By providing a gap between a coil turn and the support, liquid can be wicked into the gap and held in the gap for vaporisation. In particular, liquid can be wicked by the spaces between coil turns and into the gap between a coil turn and the support.

The vaporiser may further comprise a vaporisation cavity such that, in use, the
25 vaporisation cavity is a negative pressure cavity. At least part of the heating element may be inside the vaporisation cavity. By having the heating element in the vaporisation cavity, which in turn is a negative pressure cavity when a user inhales through the electronic cigarette, the liquid is directly vaporised and inhaled by the user.

The electronic vapour provision device may comprise a mouthpiece section and the
30 vaporiser may form part of the mouthpiece section. Moreover, the liquid store may form part of the mouthpiece section. For example, the liquid store may substantially fill the mouthpiece section.

Referring to Figure 1 there is shown an embodiment of the electronic vapour provision device 1 in the form of an electronic cigarette 1 comprising a mouthpiece 2 and a body 3. The electronic cigarette 1 is shaped like a conventional cigarette having a cylindrical shape. The mouthpiece 2 has an air outlet 4 and the electronic cigarette 1 is operated
5 when a user places the mouthpiece 2 of the electronic cigarette 1 in their mouth and inhales, drawing air through the air outlet 4. Both the mouthpiece 2 and body 3 are cylindrical and are configured to connect to each other coaxially so as to form the conventional cigarette shape.

Figures 2 shows an example of the electronic cigarette 1 of Figure 1. The body 3
10 comprises two detachable parts, comprising a battery assembly 5 part and a vaporiser 6 part, and the mouthpiece 2 comprises a liquid store 7. The electronic cigarette 1 is shown in its assembled state, wherein the detachable parts 2, 5, 6 are connected in the following order: mouthpiece 2, vaporiser 6, battery assembly 5. Liquid wicks from the liquid store 7 to the vaporiser 6. The battery assembly 5 provides electrical power to
15 the vaporiser 6 via mutual electrical contacts of the battery assembly 5 and the vaporiser 6. The vaporiser 6 vaporises the wicked liquid and the vapour passes out of the air outlet 4. The liquid may for example comprise a nicotine solution.

The battery assembly 5 comprises a battery assembly casing 8, a power cell 9, electrical contacts 10 and a control circuit 11.

20 The battery assembly casing 8 comprises a hollow cylinder which is open at a first end 12. For example, the battery assembly casing 8 may be plastic. The electrical contacts 10 are located at the first end 12 of the casing 8, and the power cell 9 and control circuit 11 are located within the hollow of the casing 8. The power cell 9 may for example be a Lithium Cell.

25 The control circuit 11 includes an air pressure sensor 13 and a controller 14 and is powered by the power cell 9. The controller 14 is configured to interface with the air pressure sensor 13 and to control provision of electrical power from the power cell 9 to the vaporiser 6.

The vaporiser 6 comprises a vaporiser casing 15, electrical contacts 16, a heating
30 element 17, a wicking element 18, a vaporisation cavity 19 and a heating element support 20.

The vaporiser casing 15 comprises a hollow cylinder which is open at both ends with an air inlet 21. For example, the vaporiser casing 15 may be formed of an aluminium alloy. The air inlet 21 comprises a hole in the vaporiser casing 15 at a first end 22 of the vaporiser casing 15. The electrical contacts 16 are located at the first end 22 of the
5 vaporiser casing 15.

The first end 22 of the vaporiser casing 15 is releasably connected to the first end 12 of the battery assembly casing 8, such that the electrical contacts 16 of the vaporiser are electrically connected to the electrical contacts 10 of the battery assembly. For example, the device 1 may be configured such that the vaporiser casing 15 connects to
10 the battery assembly casing 8 by a threaded connection.

The heating element 17 is formed of a single wire and comprises a heating element coil 23 and two leads 24, as is illustrated in Figures 4 and 5. For example, the heating element may be formed of Nichrome. The coil 23 comprises a section of the wire where the wire is formed into a helix about an axis A. At either end of the coil 23, the wire
15 departs from its helical form to provide the leads 24. The leads 24 are connected to the electrical contacts 16 and are thereby configured to route electrical power, provided by the power cell 9, to the coil 23.

The wire of the coil 23 is approximately 0.12 mm in diameter. The coil is approximately 25 mm in length, has an internal diameter of approximately 1 mm and a helix pitch of
20 approximately 420 micrometers. The void between the successive turns of the coil 23 is therefore approximately 300 micrometers.

The heating element 17 is located towards the second end 25 of the vaporiser casing 15 and is orientated such that the axis A of the coil 23 is perpendicular to the cylindrical axis B of the vaporiser casing 15. The coil 23 of the heating element 17 is thus
25 perpendicular to the longitudinal axis C of the electronic cigarette 1.

The wicking element 18 extends from the vaporiser casing 15 into contact with the liquid store 7 of the mouthpiece 2. The wicking element 18 is configured to wick liquid in the direction W from the liquid store 7 of the mouthpiece 2 to the heating element 17. In more detail, the wick 18 comprises an arc of porous material extending from a first
30 end of the coil 23, out past the second end 25 of the vaporiser casing 14 and back to a second end of the coil. For example, the porous material may be nickel foam, wherein the porosity of the foam is such that the described wicking occurs.

The vaporisation cavity 19 comprises a region within the hollow of the vaporiser casing 15 in which liquid is vaporised. The heating element 17, heating element support 20 and portions 26 of the wicking element 18 are situated within the vaporisation cavity 19.

5 The heating element support 20 is configured to support the heating element 17 and to facilitate vaporisation of liquid by the heating element 17. The heating element support 20 is an inner support and is illustrated in Figures 3, 4 and 5. The support 20 comprises a rigid cylinder of porous ceramic material. For example, the porous ceramic material is shown to have pores 20a distributed throughout the material. The support
10 20 is situated coaxially within the helix of the heating element coil 23 and is slightly longer than the coil 23, such that the ends of the support 20 protrude from the ends of the coil 23. The diameter of the cylindrical support 20 is similar to the inner diameter of the helix. As a result, the wire of the coil 23 is substantially in contact with the support 20 and is thereby supported, facilitating maintenance of the shape of the coil
15 23. The heating element coil 23 is thus coiled, or wrapped, around the heating element support 20. The solidity provides a stable and secure structure to hold the coil 23 in place. The combination of the support 20 and the coil 23 of the heating element 17 provides a heating rod 27, as illustrated in Figures 4 and 5. The heating rod is later described in more detail with reference to Figures 4 and 5.

20 The surface 28 of the support 20 provides a route for liquid from the wick element 18 to wick onto and along, improving the provision of liquid to the vicinity of the heating element 17 for vaporisation. The surface 28 of the support 20 also provides surface area for exposing wicked liquid to the heat of the heating element 17. The porosity of the support allows liquid to be stored in the heating element support 20. The support
25 is thus a further liquid store.

The mouthpiece 2 comprises a mouthpiece casing 29. The mouthpiece casing 29 comprises a hollow cylinder which is open at a first end 30, with the air outlet 4 comprising a hole in the second end 31 of the casing. For example, the mouthpiece casing may be formed of plastic.

30 The liquid store 7 is situated within the hollow of the mouthpiece casing 29. For example, the liquid store may comprise foam, wherein the foam is substantially saturated in the liquid intended for vaporisation. The cross-sectional area of the liquid

store 7 is less than that of the hollow of the mouthpiece casing so as to form an air passageway 32 between the first end 30 of the mouthpiece casing 2 and the air outlet 4.

The first end 30 of the mouthpiece casing 29 is releasably connected to the second end 25 of the vaporiser casing 15, such that the liquid store 7 is in contact with a portion 33
5 of the wicking element 18 which protrudes from the vaporiser 6.

Liquid from the liquid store 7 is absorbed by the wicking element 18 and wicks along route W throughout the wicking element 18. Liquid then wicks from the wicking element 18 onto and along the coil 23 of the heating element 17, and onto and along the support 20.

10 There exists a continuous inner cavity 34 within the electronic cigarette 1 formed by the adjacent hollow interiors' of the mouthpiece casing 29, the vaporiser casing 15 and the battery assembly casing 8.

In use, a user sucks on the second end 31 of the mouthpiece 2. This causes a drop in the air pressure throughout the inner cavity 34 of the electronic cigarette 1, particularly at
15 the air outlet 4.

The pressure drop within the inner cavity 34 is detected by the pressure sensor 13. In response to detection of the pressure drop by the pressure sensor, the controller 14 triggers the provision of power from the power cell 9 to the heating element 17 via the electrical contacts 10, 16. The coil of the heating element 17 therefore heats up. Once
20 the coil 17 heats up, liquid in the vaporisation cavity 19 is vaporised. In more detail, liquid on the heating element 17 is vaporised, liquid on the heating element support 20 is vaporised and liquid in portions 26 of the wicking element 18 which are in the immediate vicinity of the heating element 17 may be vaporised.

The pressure drop within the inner cavity 34 also causes air from outside of the
25 electronic cigarette 1 to be drawn, along route F, through the inner cavity from the air inlet 21 to the air outlet 4. As air is drawn along route F, it passes through the vaporisation cavity 19 and the air passageway 32. The vaporised liquid is therefore conveyed by the air movement along the air passageway 32 and out of the air outlet 4 to be inhaled by the user. In passing through the vaporisation cavity, along route F, the
30 air moves over the heating element 17 in a direction substantially perpendicular to the axis A of the coil 23.

As the air containing the vaporised liquid is conveyed to the air outlet 4, some of the vapour may condense, producing a fine suspension of liquid droplets in the airflow. Moreover, movement of air through the vaporiser 6 as the user sucks on the mouthpiece 2 can lift fine droplets of liquid off of the wicking element 18, the heating element 17 and/or the heating element support 20. The air passing out of the outlet
5 may therefore comprise an aerosol of fine liquid droplets as well as vaporised liquid.

The pressure drop within the vaporisation cavity 19 also encourages further wicking of liquid from the liquid store 7, along the wicking element 18, to the vaporisation cavity 19.

10 Figure 6 shows a further example of the electronic cigarette 1 of Figure 1. The body 3 is referred to herein as a battery assembly 50, and the mouthpiece 2 includes a liquid store 51 and a vaporiser 52. The electronic cigarette 1 is shown in its assembled state, wherein the detachable parts 2, 3 are connected. Liquid wicks from the liquid store 51 to the vaporiser 52. The battery assembly 50 provides electrical power to the vaporiser
15 52 via mutual electrical contacts of the battery assembly 50 and the mouthpiece 2. The vaporiser 52 vaporises the wicked liquid and the vapour passes out of the air outlet 4. The liquid may for example comprise a nicotine solution.

The battery assembly 50 comprises a battery assembly casing 53, a power cell 54, electrical contacts 55 and a control circuit 56.

20 The battery assembly casing 53 comprises a hollow cylinder which is open at a first end 57. For example, the battery assembly casing 53 may be plastic. The electrical contacts 55 are located at the first end 57 of the casing 53, and the power cell 54 and control circuit 56 are located within the hollow of the casing 53. The power cell 54 may for example be a Lithium Cell.

25 The control circuit 56 includes an air pressure sensor 58 and a controller 59 and is powered by the power cell 54. The controller 59 is configured to interface with the air pressure sensor 58 and to control provision of electrical power from the power cell 54 to the vaporiser 52, via the electrical contacts 55.

The mouthpiece 2 further includes a mouthpiece casing 60 and electrical contacts 61.
30 The mouthpiece casing 60 comprises a hollow cylinder which is open at a first end 62, with the air outlet 4 comprising a hole in the second end 63 of the casing 60. The mouthpiece casing 60 also comprises an air inlet 64, comprising a hole near the first

end 62 of the casing 60. For example, the mouthpiece casing may be formed of aluminium.

The electrical contacts 61 are located at the first end of the casing 60. Moreover, the first end 62 of the mouthpiece casing 60 is releasably connected to the first end 57 of the battery assembly casing 53, such that the electrical contacts 61 of the mouthpiece 2 are electrically connected to the electrical contacts 55 of the battery assembly 50. For example, the device 1 may be configured such that the mouthpiece casing 60 connects to the battery assembly casing 53 by a threaded connection.

The liquid store 51 is situated within the hollow mouthpiece casing 60 towards the second end 63 of the casing 60. The liquid store 51 comprises a cylindrical tube of porous material saturated in liquid. The outer circumference of the liquid store 51 matches the inner circumference of the mouthpiece casing 60. The hollow of the liquid store 51 provides an air passageway 65. For example, the porous material of the liquid store 51 may comprise foam, wherein the foam is substantially saturated in the liquid intended for vaporisation.

The vaporiser 52 comprises a vaporisation cavity 66, a heating element support 67 and a heating element 68.

The vaporisation cavity 66 comprises a region within the hollow of the mouthpiece casing 60 in which liquid is vaporised. The heating element 68 and a portion 69 of the support 67 are situated within the vaporisation cavity 66.

The heating element support 67 is configured to support the heating element 68 from the outside and to facilitate vaporisation of liquid by the heating element 68 and is illustrated in Figures 7 to 9. Because the support 67 is located outside of the heating element 68, its size is not restricted by the size of the heating element, and so can be much larger than those of the embodiments described above. This facilitates the storing of more liquid by the porous heating element support 67 than those of the embodiments described above. The support 67 comprises a hollow cylinder of rigid, porous material and is situated within the mouthpiece casing 60, towards the first end 62 of the casing 60, such that it abuts the liquid store 51. The porous material has pores 67a distributed throughout. The outer circumference of the support 67 matches the inner circumference of the mouthpiece casing 60. The hollow of the support comprises a longitudinal, central channel 70 through the length of the support 67. The

channel 70 has a square cross-sectional shape, the cross-section being perpendicular to the longitudinal axis of the support.

The support 67 acts as a wicking element, as it is configured to wick liquid in the direction W from the liquid store 51 of the mouthpiece 2 to the heating element 68. For
5 example, the porous material of the support 67 may be nickel foam, wherein the porosity of the foam is such that the described wicking occurs. Once liquid wicks W from the liquid store 51 to the support 67, it is stored in the porous material of the support 67. Thus, the support 67 is an extension of the liquid store 51.

The heating element 68 is formed of a single wire and comprises a heating element coil
10 71 and two leads 72, as is illustrated in Figures 8 and 9. For example, the heating element 68 may be formed of Nichrome. The coil 71 comprises a section of the wire where the wire is formed into a helix about an axis A. At either end of the coil 71, the wire departs from its helical form to provide the leads 72. The leads 72 are connected to the electrical contacts 61 and are thereby configured to route electrical power,
15 provided by the power cell 54, to the coil 71.

The wire of the coil 71 is approximately 0.12 mm in diameter. The coil is approximately 25 mm in length, has an internal diameter of approximately 1 mm and a helix pitch of approximately 420 micrometers. The void between the successive turns of the coil 71 is therefore approximately 300 micrometers.

20 The coil 71 of the heating element 68 is located coaxially within the channel 70 of the support. The heating element coil 71 is thus coiled within the channel 70 of the heating element support 67. Moreover, the axis A of the coil 71 is thus parallel to the cylindrical axis B of the mouthpiece casing 60 and the longitudinal axis C of the electronic cigarette 1.

25 The coil 71 is the same length as the support 67, such that the ends of the coil 71 are flush with the ends of the support 67. The outer diameter of the helix of the coil 71 is similar to the cross-sectional width of the channel 70. As a result, the wire of the coil 71 is in contact with the surface 73 of the channel 70 and is thereby supported, facilitating maintenance of the shape of the coil 71. Each turn of the coil is in contact with the
30 surface 73 of the channel 70 at a contact point 75 on each of the four walls 73 of the channel 70. The combination of the coil 71 and the support 67 provides a heating rod

74, as illustrated in Figures 8 and 9. The heating rod 74 is later described in more detail with reference to Figures 8 and 9.

The inner surface 73 of the support 67 provides a surface for liquid to wick onto the coil 71 at the points 75 of contact between the coil 71 and the channel 70 walls 73. The inner
5 surface 73 of the support 67 also provides surface area for exposing wicked liquid to the heat of the heating element 68.

There exists a continuous inner cavity 76 within the electronic cigarette 1 formed by the adjacent hollow interiors' of the mouthpiece casing 60 and the battery assembly casing
53.

10 In use, a user sucks on the second end 63 of the mouthpiece casing 60. This causes a drop in the air pressure throughout the inner cavity 76 of the electronic cigarette 1, particularly at the air outlet 4.

The pressure drop within the inner cavity 76 is detected by the pressure sensor 58. In response to detection of the pressure drop by the pressure sensor 58, the controller 59
15 triggers the provision of power from the power cell 54 to the heating element 68 via the electrical contacts 55, 26. The coil of the heating element 68 therefore heats up. Once the coil 17 heats up, liquid in the vaporisation cavity 66 is vaporised. In more detail, liquid on the coil 71 is vaporised, liquid on the inner surface 73 of the heating element support 67 is vaporised and liquid in the portions 22 of the support 67 which are in the
20 immediate vicinity of the heating element 68 may be vaporised.

The pressure drop within the inner cavity 76 also causes air from outside of the electronic cigarette 1 to be drawn, along route F, through the inner cavity from the air inlet 64 to the air outlet 4. As air is drawn along route F, it passes through the vaporisation cavity 66, picking up vaporised liquid, and the air passageway 65. The
25 vaporised liquid is therefore conveyed along the air passageway 65 and out of the air outlet 4 to be inhaled by the user. In passing through the vaporisation cavity, along route F, the air moves over the heating element 68 in a direction substantially parallel to the axis A of the coil 71.

As the air containing the vaporised liquid is conveyed to the air outlet 4, some of the
30 vapour may condense, producing a fine suspension of liquid droplets in the airflow. Moreover, movement of air through the vaporiser 52 as the user sucks on the mouthpiece 2 can lift fine droplets of liquid off of the heating element 68 and/or the

heating element support 67. The air passing out of the air outlet 4 may therefore comprise an aerosol of fine liquid droplets as well as vaporised liquid.

With reference to Figures 8 and 9, due to the cross-sectional shape of the channel, gaps 80 are formed between the inner surface 73 of the heating element support 67 and the coil 71. In more detail, where the wire of the coil 71 passes between contact points 75, a gap 80 is provided between the wire and the area of the inner surface 73 closest to the wire due to the wire substantially maintaining its helical form. The distance between the wire and the surface 73 at each gap 80 is in the range of 10 micrometers to 500 micrometers. The gaps 80 are configured to facilitate the wicking of liquid onto the coil 71 through capillary action at the gaps 80. The gaps 80 also provide areas in which liquid can gather prior to vaporisation, and thereby provide areas for liquid to be stored prior to vaporisation. The gaps 80 also expose more of the coil 71 for increased vaporisation in these areas.

Many alternatives and variations to the embodiments described above are possible. For example, alternatives and variations to the embodiments of Figures 2 to 5 are as follows.

Figures 10 to 12 show other examples of porous heating element supports 20 with a coil 23 wound around. These differ from the example shown in Figures 2 to 5 and from each other by the shape of the heating element support 20. In each of the examples of Figures 10 to 12, gaps 80 are provided between the heating element 17 and the support 20 by virtue of the cross-sectional shape of the support. In more detail, where the wire of the coil 23 passes over a depression in the surface 28, a gap 80 is provided between the wire and the area of the surface 28 immediately under the wire due to the wire substantially maintaining its helical form. The gaps 80 are therefore disposed in a radial direction from the axis A of the coil, between the surface 28 of the support 20 and the wire of the coil 23. The distance between the wire and the surface 28 at each gap 80 is in the range of 10 micrometers to 500 micrometers. The gaps 80 are configured to facilitate the wicking of liquid onto and along the length of the support 20 through capillary action at the gaps 80. As with the heating rods of Figures 8 and 9, the gaps 80 also facilitate the wicking of liquid onto the heating element 17 from the porous support 20 through capillary action at the gaps 80. The gaps 80 also provide areas in which liquid can gather on the surface 28 of the support 20 prior to vaporisation, and thereby provide areas for liquid to be stored prior to vaporisation. The gaps 80 also expose more of the coil 23 for increased vaporisation in these areas.

Figure 10 shows a heating element support 20 having a generally cylindrical shape but having four surface channels 81 running lengthwise and spaced equally around the support 20. The coil 23 is wound around the support 20 and gaps 80 are provided where the coil turns overlap the channels 81. In more detail, where the wire of the coil
5 23 passes over a channel 81, a gap 80 is provided between the wire and the area of the surface 28 immediately under the wire.

The heating element support 20 is porous and stores liquid. The gaps 80 provided by the channels 81 have two functions. Firstly, they provide a means for liquid to be wicked both onto the coil 23 and into the heating element support 20 by capillary
10 action. Secondly, they expose the coil 23 surface in the area of the channels 81 thereby increasing the vaporisation surface of the coil 23.

In Figure 11, the heating element support 20 has an octagonal outer cross-sectional shape, perpendicular to the lengthwise direction. The coil 23 is wound around this support. Because the coil 23 is wire of some rigidity, the wire form does not match the
15 exact outer form of the support, but tends to be curved. Thus, gaps 80 are provided between the outer octagonal surface of the heating element support 20 and the curved coil 23.

Again, the heating element support 20 is porous for liquid storage and the gaps 80 provide a means of wicking liquid onto the coil 23, and expose a greater surface of the
20 coil 23 for increased vaporisation.

In Figure 12, the heating element support 20 has an outer cross-sectional shape equal to a four arm cross. The coil 23 is wound around the support 20 and gaps 80 are provided between respective arms and the coil 23 surface. These gaps 80 provide the same advantages already described.

25 Moreover, where channels 81 are provided in the heating element support 20, a number other than one or four channels 81 can be used.

Furthermore, channels 81 have been described as longitudinal grooves along the surface 28 of cylindrical supports 20. However, the channels 81 may, for example, alternatively or additionally comprise helical grooves in the surface 28 of a cylindrical
30 support 20, spiralling about the axis of the support. Alternatively or additionally the channels 81 may comprise circumferential rings around the surface 28 of the support 20.

In embodiments, the inner support 20 is described as being slightly longer than the coil 23, such that it protrudes from either end of the coil 23. Alternatively, the support 20 may be shorter in length than the coil 23 and may therefore reside entirely within the bounds of the coil.

5 Furthermore, example alternatives and variations to the embodiments of Figures 6 to 9 are as follows. Figures 13 to 15 show other examples of outer porous heating element supports 67 with an internal coil 71. These differ from the example shown in Figures 7 and 9 and from each other by the shape of the heating element support 67.

10 Figure 13 shows a device similar to that shown in Figure 9 with the exception that the internal channel 70 has a circular cross-sectional shape rather than a square. This provides an arrangement where a coil 71 is fitted into the internal channel 70 and is in contact with the channel 70 surface along the length of the channel 70 substantially without gaps in the contact areas. This extra contact provides an increased means for liquid to be wicked onto the coil 71 and a general decrease in the vaporisation area of
15 the coil 71.

In Figure 14 a device is shown similar to that shown in Figure 9. In this example, the outer cross-sectional shape of the heating element support 67 is a square rather than a circle.

20 Figure 15 shows a heating element support 67 comprising a first support section 85 and a second support section 86. The heating element support 67 is generally cylindrical in shape and the first support section 85 and second support section 86 are half cylinders with generally semi-circular cross-sections, which are joined together to form the cylindrical shape of the heating element support 67.

25 The first support section 85 and second support section 86 each have a side channel 87, or groove 87, running along their respective lengths, along the middle of their otherwise flat longitudinal surfaces. When the first support section 85 is joined to the second support section 86 to form the heating element support 67, their respective side channels 87 together form the heating elements support 67 internal channel 70.

30 In this example, the combined side channels 87 form an internal channel 70 having a square cross-sectional shape. Thus, the side channels 87 are each rectangular in cross-section. The coil 71 is situated within the heating element support 67 internal channel 70. Having a heating element support 67 that comprises two separate parts 85, 86

facilitates manufacture of this component. During manufacturing, the coil 71 can be fitted into the side channel 87 of the first support section 85, and the second support section 86 can be placed on top to form the completed heating element support 67.

Internal support channels 70 with cross-sectional shapes other than those described
5 could be used.

Moreover, the coil 71 may be shorter in length than the outer support 67 and may therefore reside entirely within the bounds of the support. Alternatively, the coil 71 may be longer than the outer support 67.

In embodiments, the support 67 may be located partially or entirely within liquid store
10 51. For example, the support 67 may be located coaxially within the tube of the liquid store 51.

Furthermore, example alternatives and variations to the embodiments described above are as follows.

An electronic vapour provision device comprising an electronic cigarette 1 is described
15 herein. However, other types of electronic vapour provision device are possible.

The wire of the coil 23, 71 is described above as being approximately 0.12 mm thick. However, other wire diameters are possible. For example, the diameter of the coil wire may be in the range of 0.05 mm to 0.2 mm. Moreover, the coil 23, 71 length may be different to that described above. For example, the coil 23, 71 length may be in the
20 range of 20 mm to 40 mm.

The internal diameter of the coil 23, 71 may be different to that described above. For example, the internal diameter of the coil 23, 71 may be in the range of 0.5 mm to 2 mm.

The pitch of the helical coil 23, 71 may be different to that described above. For
25 example, the pitch may be between 120 micrometers and 600 micrometers.

Furthermore, although the distance of the voids between turns of the coil 23, 71 is described above as being approximately 300, different void distances are possible. For example, the void may be between 20 micrometers and 500 micrometers.

The size of the gaps 80 may be different to that described above.

Furthermore, the electronic vapour provision device 1 is not restricted to the sequence of components described and other sequences could be used such as the control circuit 11, 56 being in the tip of the device or the liquid store 7, 51 being in the electronic vapour provision device 1 body 3 rather than the mouthpiece 2.

- 5 The electronic vapour provision device 1 of Figure 2 is described as comprising three detachable parts, the mouthpiece 2, the vaporiser 6 and the battery assembly 5. Alternatively, the electronic vapour provision device 1 may be configured such these parts 2, 6, 5 are combined into a single integrated unit. In other words, the mouthpiece 2, the vaporiser 6 and the battery assembly 5 may not be detachable. As a further
10 alternative, the mouthpiece 2 and the vaporiser 6 may comprise a single integrated unit, or the vaporiser 6 and the battery assembly 5 may comprise a single integrated unit.

- The electronic vapour provision device 1 of Figure 6 is described as comprising two detachable parts, the mouthpiece 2 and the body comprising the battery assembly 50.
15 Alternatively, the device 1 may be configured such these parts 2, 50 are combined into a single integrated unit. In other words, the mouthpiece 2 and the body 3 may not be detachable.

The heating element 17, 68 is not restricted to being a coil 23, 71, and may be another wire form such as a zig-zag shape.

- 20 An air pressure sensor 13, 58 is described herein. In embodiments, an airflow sensor may be used to detect that a user is sucking on the device.

The heating element 17, 68 is not restricted to being a uniform coil.

- The porous material of the heating element support 20, 67 may be optimised for retention and wicking of certain liquids. For example the porous material may be
25 optimised for the retention and wicking of a nicotine solution. For instance, the nicotine solution may be liquid containing nicotine diluted in a propylene glycol solution.

The heating element support 20, 67 is not limited to being a porous ceramic and other solid porous materials could be used such as porous plastics materials or solid foams.

- 30 Reference herein to a vaporisation cavity 19, 66 may be replaced by reference to a vaporisation region.

Although examples have been shown and described it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention.

In order to address various issues and advance the art, the entirety of this disclosure
5 shows by way of illustration various embodiments in which the claimed invention(s)
may be practiced and provide for superior electronic vapour provision. The advantages
and features of the disclosure are of a representative sample of embodiments only, and
are not exhaustive and/or exclusive. They are presented only to assist in understanding
and teach the claimed features. It is to be understood that advantages, embodiments,
10 examples, functions, features, structures, and/or other aspects of the disclosure are not
to be considered limitations on the disclosure as defined by the claims or limitations on
equivalents to the claims, and that other embodiments may be utilised and
modifications may be made without departing from the scope and/or spirit of the
disclosure. Various embodiments may suitably comprise, consist of, or consist
15 essentially of, various combinations of the disclosed elements, components, features,
parts, steps, means, etc. In addition, the disclosure includes other inventions not
presently claimed, but which may be claimed in future. Any feature of any embodiment
can be used independently of, or in combination with, any other feature.

Claims

1. An electronic vapour provision device comprising a power cell, a vaporiser and a liquid store, where the vaporiser comprises a heating element and a heating element support, wherein the liquid store comprises a porous material.
5
2. The electronic vapour provision device of claim 1, wherein the electronic vapour provision device is an electronic cigarette.
- 10 3. The electronic vapour provision device of any preceding claim, wherein the liquid store comprises a rigid porous material.
4. The electronic vapour provision device of any preceding claim, wherein the liquid store comprises a porous ceramic material.
- 15 5. The electronic vapour provision device of any preceding claim, wherein the porous material is optimized for liquid retention and wicking.
6. The electronic vapour provision device of claim 5, wherein the porous material is optimized for liquid glycerine retention and wicking.
20
7. The electronic vapour provision device of any preceding claim, wherein the porous material comprises pores of substantially equal size.
- 25 8. The electronic vapour provision device of any preceding claim, wherein the porous material comprises pores distributed evenly throughout the material.
9. The electronic vapour provision device of any one of claims 1 to 7, wherein the porous material is configured such that the majority of the material volume comprises open pores for liquid storage.
30
10. The electronic vapour provision device of any preceding claim, wherein the liquid store is sealed on at least part of an outer surface region to inhibit porosity in that region.

35

11. The electronic vapour provision device of any preceding claim, wherein the porous material comprises smaller pores in the region next to the heating element and larger pores further from the heating element.
- 5 12. The electronic vapour provision device of any preceding claim, wherein the porous material comprises a gradient of pore sizes ranging from smaller pores next to the heating element to larger pores further from the heating element.
13. The electronic vapour provision device of any preceding claim, wherein the
10 liquid store is configured, in use, to wick liquid onto the heating element.
14. The electronic vapour provision device of any preceding claim, wherein the heating element support forms part of the liquid store.
- 15 15. The electronic vapour provision device of any one of claims 1 to 13, wherein the heating element support is the liquid store.
16. The electronic vapour provision device of any preceding claim, wherein the heating element is supported from its outside by the heating element support.
20
17. The electronic vapour provision device of any one of claims 1 to 15, wherein the heating element is supported from its inside by the heating element support.
18. The electronic vapour provision device of any preceding claim, wherein one or
25 more gaps are provided between the heating element and the heating element support.
19. The electronic vapour provision device of any preceding claim, wherein the heating element is a heating coil.
- 30 20. The electronic vapour provision device of claim 19, wherein the heating coil is a wire coil.
21. The electronic vapour provision device of claims 19 or 20, wherein the heating coil is coiled so as to be supported along its length by the heating element support.

22. The electronic vapour provision device of any one of claims 19 to 21, wherein the turns of the heating coil are in contact with the heating element support and are thereby supported by the heating element support.

5 23. The electronic vapour provision device of any one of claims 19 to 22, wherein one or more gaps are provided between the heating coil and the heating element support.

24. The electronic vapour provision device of claim 23, wherein the one or more
10 gaps are between the coil turns and the heating element support.

25. The electronic vapour provision device of any preceding claim, wherein the vaporiser further comprises a vaporisation cavity such that, in use, the vaporisation cavity is a negative pressure cavity.

15 26. The electronic vapour provision device of claim 25, wherein at least part of the heating element is inside the vaporisation cavity.

27. The electronic vapour provision device of any preceding claim, wherein the
20 electronic vapour provision device comprises a mouthpiece section and the vaporiser forms part of the mouthpiece section.

28. The electronic vapour provision device of claim 27, wherein the liquid store forms part of the mouthpiece section.

25 29. The electronic vapour provision device of claim 28, wherein the liquid store substantially fills the mouthpiece section.

30. The vaporiser of any preceding claim.

30 31. The mouthpiece of any one of claims 27 to 29.

32. An electronic vapour provision device comprising
a heating element for vaporising liquid;
35 an air outlet for vaporised liquid from the heating element; and

a porous heating element support, wherein the heating element support is a store of liquid.

- 5 33. An electronic vapour provision device comprising
a heating element for vaporising liquid;
a power cell for powering the heating element;
an air outlet for vaporised liquid from the heating element; and
a porous heating element support, wherein the heating element support is a
store of liquid.
- 10 34. An electronic vapour provision device, substantially as described herein with
reference to the accompanying drawings.
- 15 35. A vaporiser, substantially as described herein with reference to the
accompanying drawings.

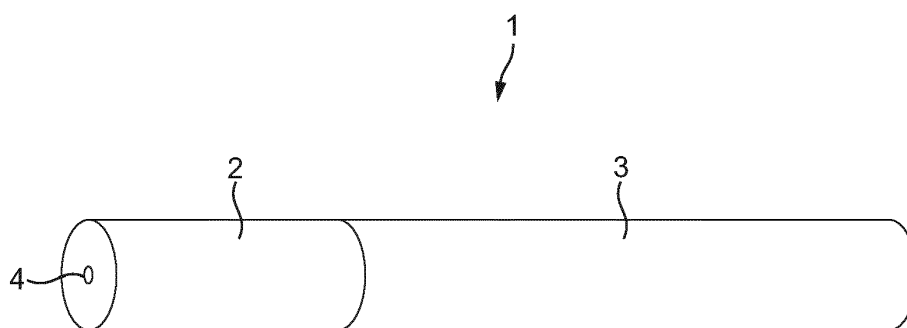
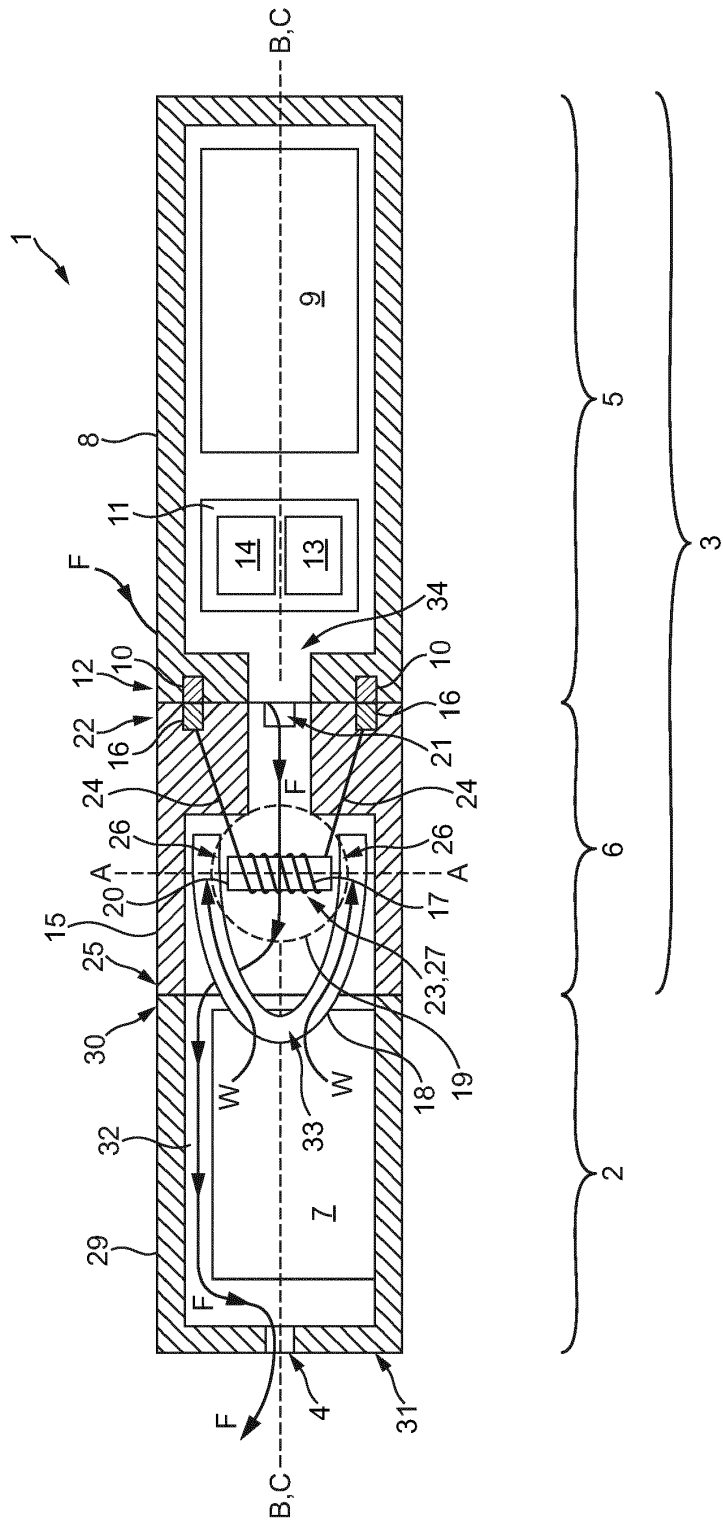


FIG. 1



3 / 7



FIG. 3

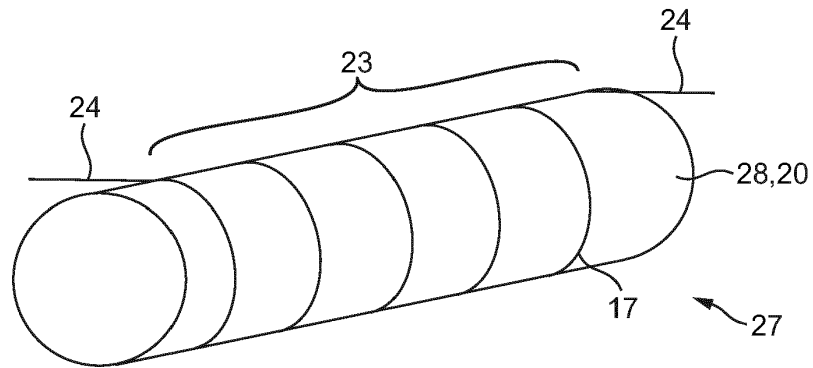


FIG. 4

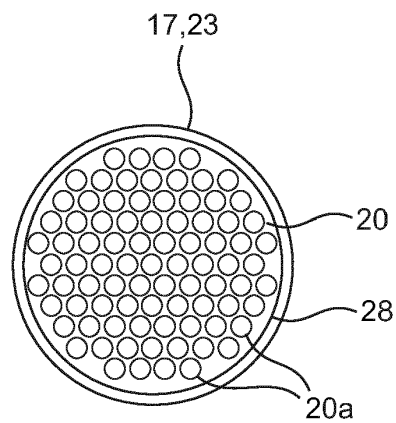
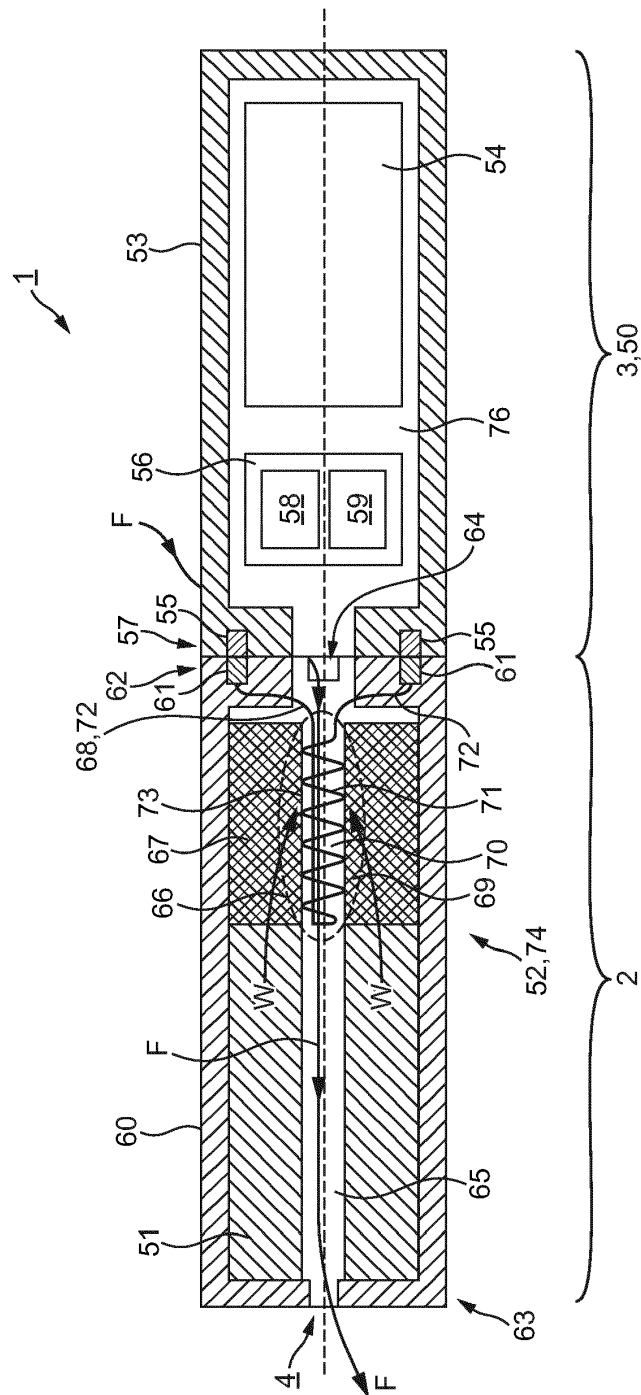


FIG. 5



5 / 7

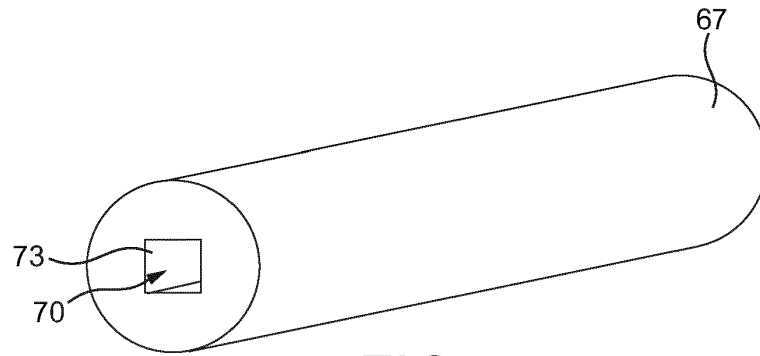


FIG. 7

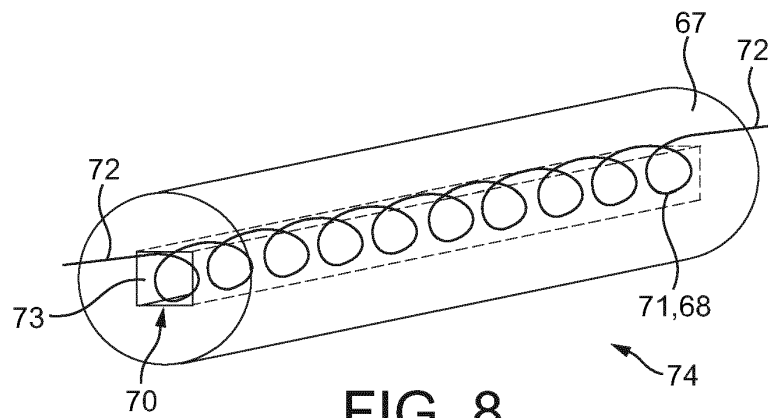


FIG. 8

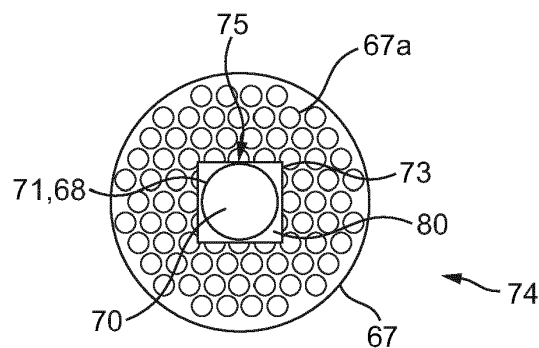


FIG. 9

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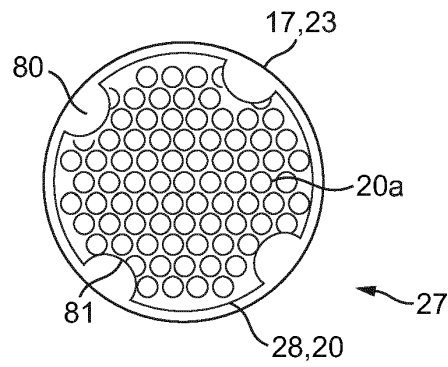


FIG. 10

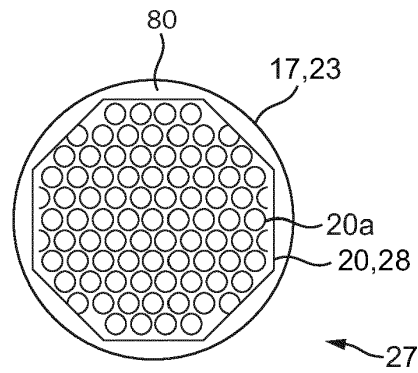


FIG. 11

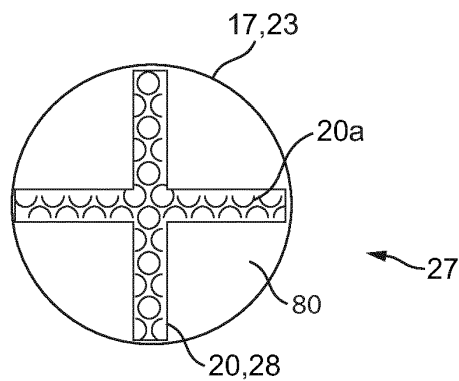


FIG. 12

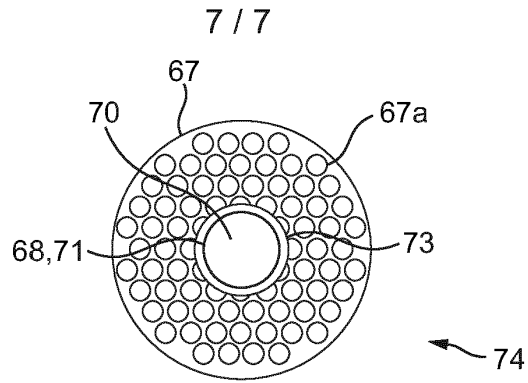


FIG. 13

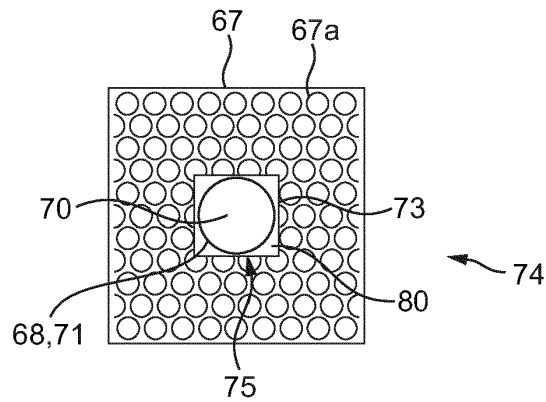


FIG. 14

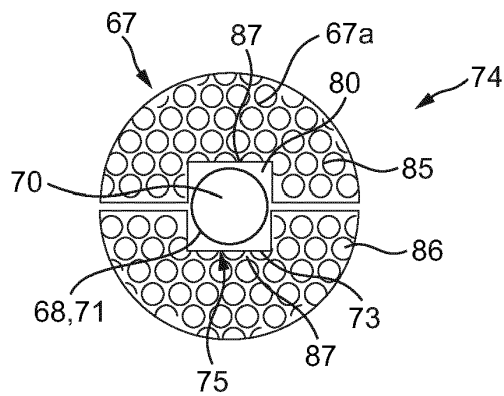


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 404 515 A1 (HON LIK [CN]) 11 January 2012 (2012-01-11) the whole document -----	1-13, 17, 19-22, 25-35
X	DE 10 2007 011120 A1 (BEL AIR INTERNAT CORP [US]) 11 September 2008 (2008-09-11) the whole document -----	1-3
A	EP 2 113 178 A1 (PHILIP MORRIS PROD [CH]) 4 November 2009 (2009-11-04) the whole document -----	1-35



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
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TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,

[Continued on next page]

(54) Title: SINGLE-USE CONNECTOR AND CARTRIDGE FOR A SMOKING ARTICLE AND RELATED METHOD

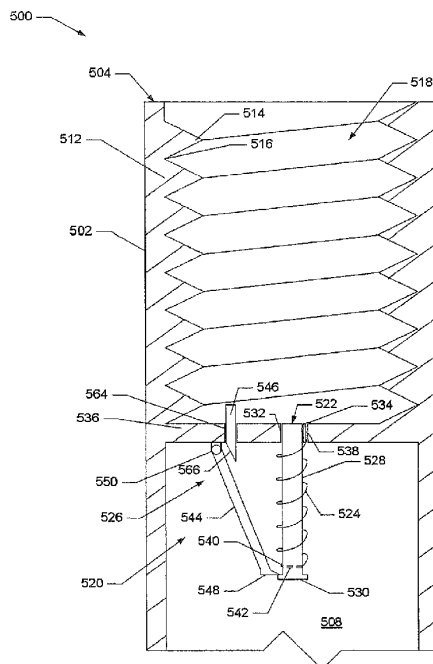


FIG. 4

(57) Abstract: The present disclosure relates to connectors that may be employed in cartridges for smoking articles. The connectors may include a single-use mechanism that may include a blocking pin, a biasing mechanism, and a release mechanism. The release mechanism may hold the blocking pin in a partially retracted position in which the blocking pin is at least partially retracted from an aperture extending through threads defined by the connector. The release mechanism may include a latch that is displaced from contact with the blocking pin by a release pin upon engagement of the connector with a mating connector. The biasing mechanism may force the blocking pin against an end of the mating connector such that when the mating connector is unscrewed from the connector, the blocking pin extends through the aperture and blocks at least one recess defined between the threads such that the connector may not be reused.

WO 2014/039308 A1



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

SINGLE-USE CONNECTOR AND CARTRIDGE FOR A SMOKING ARTICLE AND RELATED METHOD

FIELD OF THE DISCLOSURE

The present disclosure relates to single-use connectors, and more particularly to single-use connectors for use in cartridges that may hold a product which, when employed with aerosol delivery articles, may yield tobacco components or other materials in an inhalable form. The product may be made or derived from tobacco or otherwise incorporate tobacco for human
5 consumption.

BACKGROUND

Many smoking articles have been proposed through the years as improvements upon, or alternatives to, smoking products based upon combusting tobacco. Exemplary alternatives have
10 included devices wherein a solid or liquid fuel is combusted to transfer heat to tobacco or wherein a chemical reaction is used to provide such heat source. Numerous references have proposed various smoking articles of a type that generate flavored vapor, visible aerosol, or a mixture of flavored vapor and visible aerosol. Some of those proposed types of smoking articles include tubular sections or longitudinally extending air passageways.

15 The point of the improvements or alternatives to smoking articles typically has been to provide the sensations associated with cigarette, cigar, or pipe smoking, without delivering considerable quantities of incomplete combustion and pyrolysis products. To this end, there have been proposed numerous smoking products, flavor generators, and medicinal inhalers which utilize electrical energy to vaporize or heat a volatile material, or attempt to provide the sensations of
20 cigarette, cigar, or pipe smoking without burning tobacco.

General examples of alternative smoking articles are described in US Pat. No. 3,258,015 to Ellis et al.; US Pat. No. 3,356,094 to Ellis et al.; US Pat. No. 3,516,417 to Moses; US Pat. No. 4,347,855 to Lanzellotti et al.; US Pat. No. 4,340,072 to Bolt et al.; US Pat. No. 4,391,285 to Burnett et al.; US Pat. No. 4,917,121 to Riehl et al.; US Pat. No. 4,924,886 to Litzinger; and US
25 Pat. No. 5,060,676 to Hearn et al. Many of those types of smoking articles have employed a combustible fuel source that is burned to provide an aerosol and/or to heat an aerosol-forming material. See, for example, the background art cited in US Pat. No. 4,714,082 to Banerjee et al. and US Pat. No. 4,771,795 to White et al.; which are incorporated herein by reference in their entireties. See, also, for example, those types of smoking articles described in US Pat. No. 4,756,318 to
30 Clearman et al.; US Pat. No. 4,714,082 to Banerjee et al.; US Pat. No. 4,771,795 to White et al.; US

Pat. No. 4,793,365 to Sensabaugh et al.; US Pat. No. 4,917,128 to Clearman et al.; US Pat. No. 4,961,438 to Korte; US Pat. No. 4,966,171 to Serrano et al.; US Pat. No. 4,969,476 to Bale et al.; US Pat. No. 4,991,606 to Serrano et al.; US Pat. No. 5,020,548 to Farrier et al.; US Pat. No. 5,033,483 to Clearman et al.; US Pat. No. 5,040,551 to Schlatter et al.; US Pat. No. 5,050,621 to Creighton et al.; US Pat. No. 5,065,776 to Lawson; US Pat. No. 5,076,296 to Nystrom et al.; US Pat. No. 5,076,297 to Farrier et al.; US Pat. No. 5,099,861 to Clearman et al.; US Pat. No. 5,105,835 to Drewett et al.; US Pat. No. 5,105,837 to Barnes et al.; US Pat. No. 5,115,820 to Hauser et al.; US Pat. No. 5,148,821 to Best et al.; US Pat. No. 5,159,940 to Hayward et al.; US Pat. No. 5,178,167 to Riggs et al.; US Pat. No. 5,183,062 to Clearman et al.; US Pat. No. 5,211,684 to Shannon et al.; US Pat. No. 5,240,014 to Deevi et al.; US Pat. No. 5,240,016 to Nichols et al.; US Pat. No. 5,345,955 to Clearman et al.; US Pat. No. 5,551,451 to Riggs et al.; US Pat. No. 5,595,577 to Bensalem et al.; US Pat. No. 5,819,751 to Barnes et al.; US Pat. No. 6,089,857 to Matsuura et al.; US Pat. No. 6,095,152 to Beven et al.; US Pat. No. 6,578,584 Beven; and US Pat. No. 6,730,832 to Dominguez; which are incorporated herein by reference in their entireties.

Furthermore, certain types of cigarettes that employ carbonaceous fuel elements have been commercially marketed under the brand names "Premier" and "Eclipse" by R. J. Reynolds Tobacco Company. See, for example, those types of cigarettes described in Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company Monograph (1988) and Inhalation Toxicology, 12:5, p. 1-58 (2000). See also US Pat. Pub. No. 2005/0274390 to Banerjee et al., US Pat. Pub. No. 2007/0215167 to Crooks et al., US Pat. Pub. No. 2010/0065075 to Banerjee et al., and US Pat. Pub. No. 2012/0042885 to Stone et al., the disclosures of which are incorporated herein by reference in their entireties.

Certain proposed cigarette-shaped tobacco products purportedly employ tobacco in a form that is not intended to be burned to any significant degree. See, for example, US Pat. No. 4,836,225 to Sudoh; US Pat. No. 4,972,855 to Kuriyama et al.; and US Pat. No. 5,293,883 to Edwards, which are incorporated herein by reference in their entireties. Yet other types of smoking articles, such as those types of smoking articles that generate flavored vapors by subjecting tobacco or processed tobaccos to heat produced from chemical or electrical heat sources, are described in US Pat. No. 4,848,374 to Chard et al.; US Patent Nos. 4,947,874 and 4,947,875 to Brooks et al.; US Pat. No. 5,060,671 to Counts et al.; US Pat. No. 5,146,934 to Deevi et al.; US Pat. No. 5,224,498 to Deevi; US Pat. No. 5,285,798 to Banerjee et al.; US Pat. No. 5,357,984 to Farrier et al.; US Pat. No. 5,593,792 to Farrier et al.; US Pat. No. 5,369,723 to Counts; US Pat. No. 5,692,525 to Counts et al.; US Pat. No. 5,865,185 to Collins et al.; US Pat. No. 5,878,752 to Adams et al.; US Pat. No. 5,880,439 to Deevi et al.; US Pat. No. 5,915,387 to Baggett et al.; US Pat. No. 5,934,289 to

Watkins et al.; US Pat. No. 6,033,623 to Deevi et al.; US Pat. No. 6,053,176 to Adams et al.; US Pat. No. 6,164,287 to White; US Pat. No. 6,289,898 to Fournier et al.; US Pat. No. 6,615,840 to Fournier et al.; U.S. Pat. Pub. No. 2003/0131859 to Li et al.; U.S. Pat. Pub. No. 2005/0016549 to Banerjee et al.; and U.S. Pat. Pub. No. 2006/0185687 to Hearn et al., each of which is incorporated
5 herein by reference in its entirety.

Certain attempts have been made to deliver vapors, sprays or aerosols, such as those possessing or incorporating flavors and/or nicotine. See, for example, the types of devices set forth in US Pat. Nos. 4,190,046 to Virag; 4,284,089 to Ray; 4,635,651 to Jacobs; 4,735,217 to Gerth et al.; 4,800,903 to Ray et al.; 5,388,574 to Ingebrethsen et al.; 5,799,663 to Gross et al.; 6,532,965 to
10 Abhulimen et al.; and 6,598,607 to Adiga et al.; and EP 1,618,803 to Hon; which are incorporated herein by reference in their entireties. See also, US Pat. No. 7,117,867 to Cox et al. and the devices set forth on the website, www.e-cig.com, which are incorporated herein by reference in their entireties.

Still further representative cigarettes or smoking articles that have been described and, in
15 some instances, been made commercially available include those described in US Pat No. 4,922,901 to Brooks et al.; US Pat. No. 5,249,586 to Morgan et al.; US Pat. No. 5,388,594 to Counts et al.; US Pat. No. 5,666,977 to Higgins et al.; US Pat No. 6,196,218 to Voges; US Pat. No. 6,810,883 to Felter et al.; US Pat. No. 6,854,461 to Nichols; US Pat. No. 7,832,410 to Hon; US Pat. No. 7,513,253 to Kobayashi; U.S. Pat. No. 7,726,320 to Robinson et al.; US Pat. No. 7,896,006 to
20 Hamano; US Pat. No. 6,772,756 to Shayan; US Pat. Pub. No. 2009/0095311 to Hon; US Pat. Pub. Nos. 2006/0196518, 2009/0126745, and 2009/0188490 to Hon; US Pat. Pub. No. 2009/0272379 to Thorens et al.; US Pat. Pub. Nos. 2009/0260641 and 2009/0260642 to Monsees et al.; US Pat. Pub. Nos. 2008/0149118 and 2010/0024834 to Oglesby et al.; US Pat. Pub. No. 2010/0307518 to Wang; and WO 2010/091593 to Hon. See also US Pat. No. D657,047 to Minskoff et al. and US Pat. Pub.
25 Nos. 2011/0277757, 2011/0277760, and US 2011/0277764 to Terry et al. Still further examples include electronic cigarette products commercially available under the names ACCORD[®]; HEATBAR[™]; HYBRID CIGARETTE[®]; VEGAS[™]; E-GAR[™]; C-GAR[™]; E-MYSTICK[™]; IOLITE[®] Vaporizer, GREEN SMOKE[®], BLU[™] Cigs, WHITE CLOUD[®] Cirrus, V2CIGS[™], SOUTH BEACH SMOKE[™], SMOKETIP[®], SMOKE STIK[®], NJOY[®], LUCI[®], Royal Blues,
30 SMART SMOKER[®], SMOKE ASSIST[®], Knight Sticks, GAMUCCI[®], InnoVapor, SMOKING EVERYWHERE[®], Crown 7, CHOICE[™] NO.7[™], VAPORKING[®], EPUFFER[®], LOGIC[™] ecig, VAPOR4LIFE[®], NICOTEK[®], METRO[®], VUSE[®], and PREMIUM[™].

However, advances with respect to cartridges for storing and releasing products for use with an electronic smoking article may be desirable.

BRIEF SUMMARY

The present disclosure provides a smoking article and related components and methods. In particular, disclosed herein is a single-use connector. The connector may comprise a body defining a plurality of threads, a plurality of recesses respectively positioned between the threads, and an aperture extending through one or more of the threads. The connector may also include a single-use mechanism. The single-use mechanism may comprise a blocking pin configurable between a retracted position in which the blocking pin is at least partially retracted from the aperture and an extended position in which the blocking pin extends through the aperture and blocks at least one of the recesses. The single-use mechanism may additionally include a biasing mechanism configured to bias the blocking pin toward the extended position and a release mechanism configured to retain the blocking pin in the retracted position and release the blocking pin after the threads and the recesses engage a mating connector.

In some embodiment the threads and the recesses may be defined at an inner surface of the body surrounding a cavity configured to receive the mating connector, whereas in other embodiments the threads and the recesses may be defined at an outer surface of the body and configured to be received in a cavity defined by the mating connector. The release mechanism may comprise a latch configured to engage the blocking pin to retain the blocking pin in the retracted position and a release pin configured to release the latch from engagement with the blocking pin. The blocking pin may define a head and the latch may be configured to engage the head of the blocking pin and pivot out of contact therewith upon being displaced by the release pin. The release pin may define a tapered end configured to engage the latch. The release pin may be configured to engage an end of the mating connector when the threads and the recesses engage the mating connector. Further, the biasing mechanism may comprise a coil spring.

In an additional aspect, a single-use cartridge is provided. The single-use cartridge may comprise a chamber configured to hold a product and a connector. For example, the connector may comprise an embodiment of the connector described above. The product may comprise an aerosol precursor composition in some embodiments. An electronic smoking article comprising the single-use cartridge is also provided.

In a further aspect, a method for assembling a connector is provided. The method may include providing a body defining a plurality of threads, a plurality of recesses, and an aperture extending through one or more of the threads. The method may additionally include providing a single-use mechanism comprising a blocking pin, a release mechanism, and a biasing mechanism. Further, the method may include coupling the single-use mechanism to the body such that the blocking pin is in a retracted position wherein the blocking pin is at least partially retracted from

the aperture by the release mechanism, wherein upon disengagement of the threads and recesses from a mating connector the release mechanism releases the blocking pin and the biasing mechanism biases the blocking pin to an extended configuration in which the blocking pin extends through the aperture and blocks at least one of the recesses.

- 5 In some embodiments of the method, coupling the single-use mechanism to the body may comprise coupling a coil spring to the body and the blocking pin. Coupling the single-use mechanism to the body may further comprise retracting the blocking pin to the retracted position and engaging the blocking pin with a latch. Additionally, coupling the single-use mechanism to the body may further comprise positioning a release pin in an extended position configured to engage
- 10 the mating connector and release the latch from the blocking pin upon engagement therewith.

The invention includes, without limitation, the following embodiments.

Embodiment 1: A single-use connector, comprising:

a body, defining:

a plurality of threads;

- 15 a plurality of recesses respectively positioned between the threads; and
 an aperture extending through one or more of the threads; and

a single-use mechanism, comprising:

- a blocking pin configurable between a retracted position in which the blocking pin is at least partially retracted from the aperture and an extended position in which the blocking pin
- 20 extends through the aperture and blocks at least one of the recesses;

 a biasing mechanism configured to bias the blocking pin toward the extended position; and

 a release mechanism configured to retain the blocking pin in the retracted position and release the blocking pin after the threads and the recesses engage a mating connector.

- 25 Embodiment 2: The single-use connector of any preceding or subsequent embodiment, wherein the threads and the recesses are defined at an inner surface of the body surrounding a cavity configured to receive the mating connector.

- Embodiment 3: The single-use connector of any preceding or subsequent embodiment, wherein the threads and the recesses are defined at an outer surface of the body and configured to
- 30 be received in a cavity defined by the mating connector.

 Embodiment 4: The single-use connector of any preceding or subsequent embodiment, wherein the release mechanism comprises:

 a latch configured to engage the blocking pin to retain the blocking pin in the retracted position; and

a release pin configured to release the latch from engagement with the blocking pin.

Embodiment 5: The single-use connector of any preceding or subsequent embodiment, wherein the blocking pin defines a head and the latch is configured to engage the head of the blocking pin and pivot out of contact therewith upon being displaced by the release pin.

5 Embodiment 6: The single-use connector of any preceding or subsequent embodiment, wherein the release pin defines a tapered end configured to engage the latch.

Embodiment 7: The single-use connector of any preceding or subsequent embodiment, wherein the release pin is configured to engage an end of the mating connector when the threads and the recesses engage the mating connector.

10 Embodiment 8: The single-use connector of any preceding or subsequent embodiment, wherein the biasing mechanism comprises a coil spring.

Embodiment 9: A single-use cartridge, comprising:

a chamber configured to hold a product; and

a connector, comprising:

15 a body, defining:

a plurality of threads;

a plurality of recesses respectively positioned between the threads; and

an aperture extending through one or more of the threads; and

a single-use mechanism, comprising:

20 a blocking pin configurable between a retracted position in which the blocking pin is at least partially retracted from the aperture and an extended position in which the blocking pin extends through the aperture and blocks at least one of the recesses;

a biasing mechanism configured to bias the blocking pin toward the extended position; and

25 a release mechanism configured to retain the blocking pin in the retracted position and release the blocking pin after the threads and the recesses engage a mating connector.

Embodiment 10: The single-use cartridge of any preceding or subsequent embodiment, wherein the threads and the recesses are defined at an inner surface of the body surrounding a cavity configured to receive the mating connector.

30 Embodiment 11: The single-use cartridge of any preceding or subsequent embodiment, wherein the threads and the recesses are defined at an outer surface of the body and configured to be received in a cavity defined by the mating connector.

Embodiment 12: The single-use cartridge of any preceding or subsequent embodiment, wherein the release mechanism comprises:

a latch configured to engage the blocking pin to retain the blocking pin in the retracted position; and

a release pin configured to release the latch from engagement with the blocking pin.

Embodiment 13: The single-use cartridge of any preceding or subsequent embodiment, wherein the blocking pin defines a head and the latch is configured to engage the head of the blocking pin and pivot out of contact therewith upon being displaced by the release pin.

Embodiment 14: The single-use cartridge of any preceding or subsequent embodiment, wherein the release pin defines a tapered end configured to engage the latch.

Embodiment 15: The single-use cartridge of any preceding or subsequent embodiment, wherein the release pin is configured to engage an end of the mating connector when the threads and the recesses engage the mating connector.

Embodiment 16: The single-use cartridge of any preceding or subsequent embodiment, wherein the biasing mechanism comprises a coil spring.

Embodiment 17: The single-use cartridge of any preceding or subsequent embodiment, wherein the product comprises an aerosol precursor composition.

Embodiment 18: An electronic smoking article comprising the single-use cartridge of any preceding or subsequent embodiment.

Embodiment 19: A method for assembling a connector, comprising:

providing a body defining a plurality of threads, a plurality of recesses, and an aperture extending through one or more of the threads;

providing a single-use mechanism comprising a blocking pin, a release mechanism, and a biasing mechanism;

coupling the single-use mechanism to the body such that the blocking pin is in a retracted position wherein the blocking pin is at least partially retracted from the aperture by the release mechanism, wherein upon disengagement of the threads and recesses from a mating connector the release mechanism releases the blocking pin and the biasing mechanism biases the blocking pin to an extended configuration in which the blocking pin extends through the aperture and blocks at least one of the recesses.

Embodiment 20: The method of any preceding or subsequent embodiment, wherein coupling the single-use mechanism to the body comprises coupling a coil spring to the body and the blocking pin.

Embodiment 21: The method of any preceding or subsequent embodiment, wherein coupling the single-use mechanism to the body further comprises retracting the blocking pin to the retracted position and engaging the blocking pin with a latch.

Embodiment 22: The method of any preceding or subsequent embodiment, wherein coupling the single-use mechanism to the body further comprises positioning a release pin in an extended position configured to engage the mating connector and release the latch from the blocking pin upon engagement therewith.

5 These and other features, aspects, and advantages of the disclosure will be apparent from a reading of the following detailed description together with the accompanying drawings, which are briefly described below. The invention includes any combination of two, three, four, or more of the above-noted embodiments as well as combinations of any two, three, four, or more features or elements set forth in this disclosure, regardless of whether such features or elements are expressly
10 combined in a specific embodiment description herein. This disclosure is intended to be read holistically such that any separable features or elements of the disclosed invention, in any of its various aspects and embodiments, should be viewed as intended to be combinable unless the context clearly dictates otherwise.

 Aspects of the present disclosure thus address the identified needs and provide other
15 advantages as otherwise detailed herein.

BRIEF DESCRIPTION OF THE FIGURES

Having thus described the disclosure in the foregoing general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

20 FIG. 1 illustrates a sectional view through an embodiment of a smoking article comprising a control body and a cartridge according to an embodiment of the present disclosure;

 FIG. 2 illustrates an embodiment of a single-use cartridge including a threaded connector at an inner surface thereof according to an embodiment of the present disclosure;

25 FIG. 3 illustrates a view of a distal attachment end of the cartridge of FIG. 2 according to an example embodiment of the present disclosure;

 FIG. 4 illustrates a partial cut-away view through the cartridge of FIG. 2 along line 4-4 with a blocking pin of a single-use mechanism thereof configured in a retracted position according to an example embodiment of the present disclosure;

30 FIG. 5 illustrates a partial cut-away view through the cartridge of FIG. 2 along line 4-4 during engagement with a mating connector according to an example embodiment of the present disclosure;

 FIG. 6 illustrates a partial cut-away view through the cartridge of FIG. 2 along line 4-4 after disengagement from the mating connector such that the blocking pin of the single-use mechanism thereof is configured in an extended position according to an embodiment of the present disclosure;

FIG. 7 illustrates a partial cut-away view through the cartridge of FIG. 2 along line 7-7 after disengagement from the mating connector such that the blocking pin of the single-use mechanism thereof is configured in an extended position according to an embodiment of the present disclosure;

FIG. 8 illustrates a view of a distal attachment end of a cartridge defining a threaded
5 connector on an outer surface thereof according to an example embodiment of the present disclosure;

FIG. 9 illustrates a partial cut-away view through the cartridge of FIG. 8 along line 9-9 with a blocking pin of a single-use mechanism thereof configured in a retracted position according to an example embodiment of the present disclosure;

FIG. 10 illustrates a partial cut-away view through the cartridge of FIG. 8 along line 10-10
10 after disengagement from a mating connector such that the blocking pin of the single-use mechanism thereof is configured in an extended position according to an embodiment of the present disclosure; and

FIG. 11 schematically illustrates a method for assembling a connector according to an
15 example embodiment of the present disclosure.

DETAILED DESCRIPTION

The present disclosure will now be described more fully hereinafter with reference to exemplary embodiments thereof. These exemplary embodiments are described so that this
20 disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Indeed, the present disclosure may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. As used in the specification, and in the appended claims, the singular forms “a”, “an”, “the”, include plural
25 referents unless the context clearly dictates otherwise.

The present disclosure relates to articles that use electrical energy to heat a material (preferably without combusting the material to any significant degree) to form an inhalable substance, the articles being sufficiently compact to be considered “hand-held” devices. In certain embodiments, the articles can particularly be characterized as smoking articles. As used herein, the
30 term is intended to mean an article that provides the taste and/or the sensation (e.g., hand-feel or mouth-feel) of smoking a cigarette, cigar, or pipe without substantial combustion of any component of the article. The term smoking article does not necessarily indicate that, in operation, the article produces smoke in the sense of the by-product of combustion or pyrolysis. Rather, smoking relates to the physical action of an individual in using the article – e.g., holding the article, drawing on one

end of the article, and inhaling from the article. In further embodiments, the articles to which the present disclosure relates can be characterized as being vapor-producing articles, aerosolization articles, or medicament delivery articles. Thus, the articles can be arranged so as to provide one or more substances in an inhalable state. In other embodiments, the inhalable substance can be

5 substantially in the form of a vapor (i.e., a substance that is in the gas phase at a temperature lower than its critical point). In other embodiments, the inhalable substance can be in the form of an aerosol (i.e., a suspension of fine solid particles or liquid droplets in a gas). The physical form of the inhalable substance is not necessarily limited by the nature of the articles but rather may depend upon the nature of the medium and the inhalable substance itself as to whether it exists in a vapor

10 state or an aerosol state. In some embodiments, the terms may be interchangeable. Thus, for simplicity, the terms as used to describe the articles are understood to be interchangeable unless stated otherwise.

In one aspect, the present disclosure provides a smoking article. The smoking article generally can include a number of components provided within an elongated body, which can be a

15 single, unitary shell or body or which can be formed of two or more separable pieces. For example, a smoking article according to one embodiment can comprise a shell (i.e., the elongated body) that can be substantially tubular in shape, such as resembling the shape of a conventional cigarette or cigar. Within the shell can reside all of the components of the smoking article (one or more of which may be replaceable). In other embodiments, a smoking article can comprise two shells that

20 are joined and are separable. For example, a control body can comprise a shell containing one or more reusable components and having an end that removably attaches to a cartridge. The cartridge can comprise a shell containing one or more disposable components and having an end that removably attaches to the control body. More specific arrangements of components within the single shell or within the separable control body and cartridge are evident in light of the further

25 disclosure provided herein.

Smoking articles useful according to the disclosure particularly can comprise some combination of a power source (i.e., an electrical power source), one or more control components (e.g., to control/actuate/regulate flow of power from the power source to one or more further components of the article), a heater component, and an aerosol precursor component. The smoking

30 article further can include a defined air flow path through the article such that aerosol generated by the article can be withdrawn therefrom by a user drawing on the article. Alignment of the components within the article can vary. In specific embodiments, the aerosol precursor component can be located near an end of the article that is proximal to the mouth of a user so as to maximize aerosol delivery to the user. Other configurations, however, are not excluded. Generally, the

heater component can be positioned sufficiently near the aerosol precursor component so that heat from the heater component can volatilize the aerosol precursor (as well as one or more flavorants, medicaments, or the like that may likewise be provided for delivery to a user) and form an aerosol for delivery to the user. When the heating member heats the aerosol precursor component, an
5 aerosol (alone or including a further inhalable substance) is formed, released, or generated in a physical form suitable for inhalation by a consumer. It should be noted that the foregoing terms are meant to be interchangeable. As such, the terms release, generate, and form can be interchangeable, the terms releasing, generating, and forming can be interchangeable, the terms releases, forms, and generates can be interchangeable, and the terms released, formed, and
10 generated can be interchangeable. Specifically, an inhalable substance is released as a vapor or aerosol or mixture thereof.

An exemplary smoking article 10 according to the disclosure is shown in FIG. 1. As seen in the cross-section illustrated therein, the smoking article 10 can comprise a control body 80 and a cartridge 90 that can be aligned in a functioning relationship. In this regard, the control body 80
15 and the cartridge 90 may be attachable and detachable from each other. Although a threaded engagement is illustrated in FIG. 1, it is understood that further means of engagement are encompassed, such as a press-fit engagement, a magnetic engagement, or the like. The cartridge can particularly include a single use connector as otherwise described herein.

In specific embodiments, the control body 80 may be referred to as being reusable, and the
20 cartridge 90 may be referred to as being disposable. In some embodiments, the entire smoking article may be characterized as being disposable in that the control body may be configured for only a limited number of uses (e.g., until a battery power component no longer provides sufficient power to the smoking article) with a limited number of cartridges and, thereafter, the entire smoking article 10, including the control body, may be discarded. In other embodiments, the
25 control body may have a replaceable battery such that the control body can be reused through a number of battery exchanges and with many cartridges. Similarly, the smoking article 10 may be rechargeable and thus may be combined with any type of recharging technology, including connection to a typical electrical outlet, connection to a car charger (i.e., cigarette lighter receptacle), and connection to a computer, such as through a USB cable.

30 The control body 80 includes a control component 20, a flow sensor 30, and a battery 40. Although these components are illustrated in a specific alignment, it is understood that various alignments of the components are encompassed by the present disclosure. The control body 80 further includes a plurality of indicators 19 at a distal end 12 of the control body shell 81. Such indicators 19, as discussed above, can show the number of puffs taken or remaining from the

smoking article, can be indicative of an active or inactive status, can light up in response to a puff, or the like. The indicators can be provided in varying numbers and can take on different shapes and can even being simply an opening in the body (such as for release of sound when such indicators are present).

5 Various positions for one or more air intakes 17 are encompassed by the present disclosure. As shown, the air intake 17 may be positioned in the control body shell 81 such that air drawn through the intake sufficiently contacts the flow sensor 30 to activate the sensor (although other positions are encompassed, particularly if different sensing means are provided or if manual actuation, such as with a push button, is provided). A receptacle 60 also is included at the proximal
10 attachment end 13 of the control body 80 and extends into the control body projection 82 to allow for ease of electrical connection with the resistive heating element 50 when the cartridge 90 is attached to the control body. In the illustrated embodiment, the receptacle 60 includes a central open passage to facilitate air flow from the air intake in the control body into the cartridge during use of the article 10.

15 The cartridge 90 includes a cartridge shell 91 with a mouth opening 18 at the mouthend 11 thereof to allow passage of air and entrained vapor (i.e., the components of the aerosol precursor composition in an inhalable form) from the cartridge to a consumer during draw on the smoking article 10. The smoking article 10 according to the present disclosure may have an overall shape that may be defined as being substantially rod-like or substantially tubular shaped or substantially
20 cylindrically shaped. As illustrated in FIG. 1, the smoking article 10 has a substantially round cross-section; however, other cross-sectional shapes (e.g., oval, square, triangle, etc.) also are encompassed by the present disclosure. Such language that is descriptive of the physical shape of the smoking article may also be applied to the individual units of the smoking article in embodiments comprising multiple units, such as a control body and a cartridge.

25 In preferred embodiments, the smoking article 10 may take on a size that is comparative to a cigarette or cigar shape. Thus, the smoking article may have a diameter of about 5 mm to about 25 mm, about 5 mm to about 20 mm, about 6 mm to about 15 mm, or about 6 mm to about 10 mm. Such dimension may particularly correspond to the outer diameter of the control body shell 81 and/or the cartridge shell 91. The control body can have a length of about 50 mm to about 110 mm,
30 about 60 mm to about 100 mm, or about 65 mm to about 95 mm. The cartridge can have a length of about 20 mm to about 60 mm, about 25 mm to about 55 mm, or about 30 mm to about 50 mm. The overall length of the combined cartridge and control body (or the overall length of a smoking article according to the disclosure formed of a single, unitary shell) can be approximately equal to

or less than the length of a typical cigarette – e.g., about 70 mm to about 130 mm, about 80 mm to about 125 mm, or about 90 mm to about 120 mm.

5 The cartridge shell 91 of the smoking article 10 can be formed of any material suitable for forming and maintaining an appropriate conformation, such as a tubular shape, and for retaining therein the suitable components of the smoking article. The body can be formed of a single wall, as shown in FIG. 1. The cartridge shell 91 can be formed of a material (natural or synthetic) that is heat resistant so as to retain its structural integrity – e.g., does not degrade – at least at a temperature that is the heating temperature provided by the resistive heating element. In some embodiments, a heat resistant polymer may be used. In other embodiments, the body can be
10 formed from paper, such as a paper that is substantially straw-shaped, or from metal, such as stainless steel. As further discussed herein, the body, such as a paper tube, may have one or more layers associated therewith that function to substantially prevent movement of vapor therethrough. In one example, an aluminum foil layer may be laminated to one surface of the body. Ceramic materials also may be used.

15 The cartridge 90 further includes a resistive heating element 50 in the form of a metal wire coil. The resistive heating element includes terminals 51 (e.g., positive and negative terminals) at the opposing ends thereof for facilitating current flow through the resistive heating element and for attachment of the appropriate wiring (not illustrated) to form an electrical connection of the resistive heating element with the battery 40 when the cartridge 90 is connected to the control body
20 80. Specifically, a plug 65 is positioned at the distal attachment end 14 of the cartridge. When the cartridge 90 is connected to the control body 80, the plug 65 engages the receptacle 60 to form an electrical connection such that current controllably flows from the battery 40, through the receptacle and plug, and to the resistive heating element 50. The cartridge shell 91 can continue across the distal attachment end such that this end of the cartridge is substantially closed with the
25 plug protruding therefrom. As illustrated in FIG. 1, the plug 65 includes an open central passage that aligns with the open central passage in the receptacle 60 to allow air to flow from the control body 80 and into the cartridge 90.

Generally, in use, when a consumer draws on the mouthend 11 of the cartridge, the flow sensor 30 detects the change in flow and activates the control component 20 to facilitate current
30 flow through the resistive heating element 50. Thus, it is useful for air flow to travel through the control body 80 in a manner that flow sensor 30 detects air flow almost instantaneously.

The control algorithm may call for power to the resistive heating element 50 to cycle and thus maintain a defined temperature. The control algorithm therefore can be programmed to automatically deactivate the smoking article 10 and discontinue power flow through the smoking

article after a defined time lapse without a puff by a consumer. Moreover, the smoking article can include a temperature sensor to provide feedback to the control component. Such sensor can be, for example, in direct contact with the resistive heating element 50. Alternative temperature sensing means likewise may be used, such as relying upon logic control components to evaluate resistance through the resistive heating element and correlate such resistance to the temperature of the element. In other embodiments, the flow sensor 30 may be replaced by appropriate components to provide alternative sensing means, such as capacitive sensing. Still further, one or more control buttons can be included to allow for manual actuation by a consumer to elicit a variety of functions, such as powering the article 10 on and off, turning on the heating element 50 to generate a vapor or aerosol for inhalation, or the like.

When the flow sensor 30 is positioned within the control body 80, it can be useful to have an air intake 17 on the control body. If desired, a sealed flow path can be provided such that the flow sensor 30 within the control body 80 is in fluid connection with the cartridge interior after the cartridge and the control body are engaged, such fluid connection being sealed with respect to the remainder of the components within the control body but opening into the cartridge 90 when attached to the control body. Further, in other embodiments, the flow sensor 30 can be located within the cartridge 90 instead of the control body 80.

A reservoir may utilize a transport element to transport an aerosol precursor composition to an aerosolization zone. One such example is shown in FIG. 1. As seen therein, the cartridge 90 includes a reservoir layer 201 comprising layers of nonwoven fibers formed into the shape of a tube encircling the interior of the cartridge shell 91, in this embodiment. An aerosol precursor composition is retained in the reservoir layer 201. Liquid components, for example, can be sorptively retained by the reservoir layer 201. The reservoir layer 201 is in fluid connection with a transport element 301 (a wick in this embodiment). The wick 301 transports the aerosol precursor composition stored in the reservoir layer 201 via capillary action to an aerosolization zone 400 of the cartridge 90. As illustrated, the wick 301 is in direct contact with the resistive heating element 50 that is in the form of a metal wire coil in this embodiment.

In use, when a user draws on the article 10, the resistive heating element 50 is activated (e.g., such as via a puff sensor), and the components for the aerosol precursor composition are vaporized in the aerosolization zone 400. Drawing upon the mouthend 11 of the article 10 causes ambient air to enter the air intake 17 and pass through the central opening in the receptacle 60 and the central opening in the plug 65. In the cartridge 90, the drawn air passes through an air passage 230 in an air passage tube 220 and combines with the formed vapor in the aerosolization zone 400 to form an aerosol. The aerosol is whisked away from the aerosolization zone, passes through an

air passage 260 in an air passage tube 250, and out the mouth opening 18 in the mouthend 11 of the article 10.

The smoking article 10 in the embodiment illustrated in FIG. 1 can be characterized as a disposable article. Accordingly, it can be desirable for the reservoir layer 201 in such embodiments to include a sufficient amount of aerosol precursor composition and any further inhalable materials (which may separately be provided on a different substrate) so that a consumer can obtain more than a single use of the smoking article. For example, the smoking article can include sufficient aerosolizable and/or inhalable materials such that the smoking article can provide a number of puffs substantially equivalent to the number of puffs (of about two seconds duration) available from a plurality of conventional cigarettes – e.g., 2 or more, 5 or more, 10 or more, or 20 or more conventional cigarettes. More particularly, a disposable, single unit article according to the embodiment of FIG. 1 can provide about 20 or more, about 50 or more, or about 100 or more puffs.

Although FIG. 1 is illustrative of a smoking article according to the present disclosure, the scope of the disclosure should not be viewed as being limited to the specific combination and/or arrangement of components illustrated therein. Rather, the present disclosure can encompass a variety of combinations of components useful in forming an electronic smoking article. Reference is made for example to the smoking articles disclosed in US Pat. App. Serial No. 13/536,438, filed June 28, 2012, and US Pat. App. Serial No. 13/432,406, filed March 28, 2012, the disclosures of which are incorporated herein by reference in their entirety. Further to the above, representative heating element and materials for use therein are described in US Pat. No. 5,060,671 to Counts et al.; US Pat. No. 5,093,894 to Deevi et al.; 5,224,498 to Deevi et al.; 5,228,460 to Sprinkel Jr., et al.; 5,322,075 to Deevi et al.; US Pat. No. 5,353,813 to Deevi et al.; US Pat. No. 5,468,936 to Deevi et al.; US Pat. No. 5,498,850 to Das; US Pat. No. 5,659,656 to Das; US Pat. No. 5,498,855 to Deevi et al.; US Pat. No. 5,530,225 to Hajaligol; US Pat. No. 5,665,262 to Hajaligol; US Pat. No. 5,573,692 to Das et al.; and US Pat. No. 5,591,368 to Fleischhauer et al., the disclosures of which are incorporated herein by reference in their entirety.

The various components of a smoking article according to the present invention can be chosen from components described in the art and commercially available. Examples of batteries that can be used according to the disclosure are described in US Pub. App. No. 2010/0028766, the disclosure of which is incorporated herein by reference in its entirety.

An exemplary mechanism that can provide puff-actuation capability includes a Model 163PC01D36 silicon sensor, manufactured by the MicroSwitch division of Honeywell, Inc., Freeport, Ill. Further examples of demand-operated electrical switches that may be employed in a heating circuit according to the present disclosure are described in US Pat. No. 4,735,217 to Gerth

et al., which is incorporated herein by reference in its entirety. Further description of current regulating circuits and other control components, including microcontrollers, that can be useful in the present smoking article are provided in US Pat. Nos. 4,922,901, 4,947,874, and 4,947,875, all to Brooks et al., US Pat. No. 5,372,148 to McCafferty et al., US Pat. No. 6,040,560 to Fleischhauer et al., and US Pat. No. 7,040,314 to Nguyen et al., all of which are incorporated herein by reference in their entireties.

The aerosol precursor, which may also be referred to as a vapor precursor composition, can comprise one or more different components. For example, the aerosol precursor can include a polyhydric alcohol (e.g., glycerin, propylene glycol, or a mixture thereof). Representative types of further aerosol precursor compositions are set forth in US Pat. No. 4,793,365 to Sensabaugh, Jr. et al.; US Pat. No. 5,101,839 to Jakob et al.; PCT WO 98/57556 to Biggs et al.; and Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company Monograph (1988); the disclosures of which are incorporated herein by reference.

Still further components can be utilized in the smoking article of the present disclosure. For example, US 5,261,424 to Sprinkel, Jr. discloses piezoelectric sensors that can be associated with the mouth-end of a device to detect user lip activity associated with taking a draw and then trigger heating; US 5,372,148 to McCafferty et al. discloses a puff sensor for controlling energy flow into a heating load array in response to pressure drop through a mouthpiece; US 5,967,148 to Harris et al. discloses receptacles in a smoking device that include an identifier that detects a non-uniformity in infrared transmissivity of an inserted component and a controller that executes a detection routine as the component is inserted into the receptacle; US 6,040,560 to Fleischhauer et al. describes a defined executable power cycle with multiple differential phases; US 5,934,289 to Watkins et al. discloses photonic-optronic components; US 5,954,979 to Counts et al. discloses means for altering draw resistance through a smoking device; US 6,803,545 to Blake et al. discloses specific battery configurations for use in smoking devices; US 7,293,565 to Griffen et al. discloses various charging systems for use with smoking devices; US 2009/0320863 by Fernando et al. discloses computer interfacing means for smoking devices to facilitate charging and allow computer control of the device; US 2010/0163063 by Fernando et al. discloses identification systems for smoking devices; and WO 2010/003480 by Flick discloses a fluid flow sensing system indicative of a puff in an aerosol generating system; all of the foregoing disclosures being incorporated herein by reference in their entireties. Further examples of components related to electronic aerosol delivery articles and disclosing materials or components that may be used in the present article include US Pat. No. 4,735,217 to Gerth et al.; US Pat. No. 5,249,586 to Morgan et

al.; US Pat. No. 5,666,977 to Higgins et al.; US Pat. No. 6,053,176 to Adams et al.; US 6,164,287 to White; US Pat No. 6,196,218 to Voges; US Pat. No. 6,810,883 to Felter et al.; US Pat. No. 6,854,461 to Nichols; US Pat. No. 7,832,410 to Hon; US Pat. No. 7,513,253 to Kobayashi; US Pat. No. 7,896,006 to Hamano; US Pat. No. 6,772,756 to Shayan; US Pat. Pub. Nos. 2009/0095311, 5 2006/0196518, 2009/0126745, and 2009/0188490 to Hon; US Pat. Pub. No. 2009/0272379 to Thorens et al.; US Pat. Pub. Nos. 2009/0260641 and 2009/0260642 to Monsees et al.; US Pat. Pub. Nos. 2008/0149118 and 2010/0024834 to Oglesby et al.; US Pat. Pub. No. 2010/0307518 to Wang; and WO 2010/091593 to Hon. A variety of the materials disclosed by the foregoing documents may be incorporated into the present devices in various embodiments, and all of the foregoing 10 disclosures are incorporated herein by reference in their entirety.

Although an article according to the disclosure may take on a variety of embodiments, as discussed in detail below, the use of the article by a consumer will be similar in scope. In particular, the article can be provided as a single unit or as a plurality of components that are combined by the consumer for use and then are dismantled by the consumer thereafter. Generally, 15 a smoking article according to the disclosure can comprise a first unit that is engagable and disengagable with a second unit, the first unit comprising the resistive heating element, and the second unit comprising the electrical power source. In some embodiments, the second unit further can comprise one or more control components that actuate or regulate current flow from the electrical power source. The first unit can comprise a distal end that engages the second unit and 20 an opposing, proximate end that includes a mouthpiece (or simply the mouthend) with an opening at a proximate end thereof. The first unit can comprise an air flow path opening into the mouthpiece of the first unit, and the air flow path can provide for passage of aerosol formed from the resistive heating element into the mouthpiece. In preferred embodiments, the first unit can be disposable. Likewise, the second unit can be reusable.

25 During use, the consumer initiates heating of the resistive heating element, the heat produced by the resistive heating element aerosolizes the aerosol precursor composition and, optionally, further inhalable substances. Such heating releases at least a portion of the aerosol precursor composition in the form of an aerosol (which can include any further inhalable substances included therewith), and such aerosol is provided within a space inside the cartridge that 30 is in fluid communication with the mouthend of the cartridge. When the consumer inhales on the mouth end of the cartridge, air is drawn through the cartridge, and the combination of the drawn air and the aerosol is inhaled by the consumer as the drawn materials exit the mouth end of the cartridge (and any optional mouthpiece present) into the mouth of the consumer. To initiate heating, the consumer may actuate a pushbutton, capacitive sensor, or similar component that

causes the resistive heating element to receive electrical energy from the battery or other energy source (such as a capacitor). The electrical energy may be supplied for a pre-determined length of time or may be manually controlled. Preferably, flow of electrical energy does not substantially proceed in between puffs on the article (although energy flow may proceed to maintain a baseline temperature greater than ambient temperature – e.g., a temperature that facilitates rapid heating to the active heating temperature). In further embodiments, heating may be initiated by the puffing action of the consumer through use of various sensors, as otherwise described herein. Once the puff is discontinued, heating will stop or be reduced. When the consumer has taken a sufficient number of puffs so as to have released a sufficient amount of the inhalable substance (e.g., an amount sufficient to equate to a typical smoking experience), the cartridge can be removed from the control housing and discarded. Indication that the cartridge is spent (i.e., the aerosol precursor composition has been substantially removed by the consumer) can be provided. In some embodiments, a single cartridge can provide more than a single smoking experience and thus may provide a sufficient content of aerosol precursor composition to simulate as much as full pack of conventional cigarettes or even more.

The foregoing description of use of the article can be applied to the various embodiments described through minor modifications, which can be apparent to the person of skill in the art in light of the further disclosure provided herein. The above description of use, however, is not intended to limit the use of the article but is provided to comply with all necessary requirements of disclosure of the present disclosure.

Applicant has determined that it may be desirable to prevent re-use of cartridges for smoking articles in some instances. In this regard, it may be desirable to prevent refilling of cartridges to ensure that a user or a third-party does not refill the cartridge with a product that differs in quality or composition from the components originally stored therein. Accordingly, issues with respect to confusion regarding the contents of a cartridge may be avoided, and various other benefits may be provided.

In this regard, FIG. 2 illustrates an embodiment of a single-use cartridge 500 in accordance with an example embodiment of the disclosure. The cartridge 500 may be employed with any of a variety of smoking articles, including the smoking articles discussed above. In this regard, the cartridge 500 may include a connector 502 at a distal attachment end 504 that may be configured to engage a control body of a smoking article. The connector 502 may comprise a single-use connector, as described below.

A mouth opening 506 may be in communication with a chamber 508 configured to hold a product 509 such as an aerosol precursor composition, which may be stored in a reservoir layer as

described above. The mouth opening 506 may be provided at a mouth end 510 of the cartridge 500. Various other components described above with respect to the example embodiments of smoking articles may be included in the cartridge 500. For example, the cartridge 500 may also include a resistive heating element with corresponding electrical terminals and a wick for directing the product 509 to the resistive heating element. In further embodiments, various other components not presently illustrated may be included therein.

Turning now to FIG. 3, a view of the distal attachment end 504 of the cartridge 500 is provided. As illustrated, the connector 502 may include a shell or body 512 comprising a plurality of threads 514 and a plurality of recesses 516 respectively positioned between the threads. The threads 514 and recesses 516 are defined at an inner surface of the body 512 and surround a cavity 518 configured to receive a mating connector (e.g., a control body projection) of a corresponding control body or other device. The connector 502 also includes a single-use mechanism 520, as discussed below.

FIG. 4 illustrates a partially cut-away view through the body 512 of the cartridge 500 along line 4-4 in FIG. 3. As illustrated in FIG. 4, the single-use mechanism 520 may comprise a blocking pin 522, a biasing mechanism 524, and a release mechanism 526. The operation of the single-use mechanism 520 will be described in detail below. Briefly, however, the blocking pin 522 may be configurable between a retracted position (see, e.g., FIG. 4) and an extended position (see, e.g., FIG. 6). The biasing mechanism 524 may be configured to bias the blocking pin 522 toward the extended position. The release mechanism 526 may be configured to retain the blocking pin 522 in the retracted position and release the blocking pin after the threads 514 and recesses 516 of the connector 502 engage a mating connector.

The blocking pin 522 may comprise a shaft 528 and a head 530. The shaft 528 of the blocking pin 522 may be received in an aperture 532 defined in the body 512 of the cartridge 500. As discussed in detail below, the aperture 532 may extend through one or more of the threads 514 of the body 512. However, in the retracted position, the blocking pin 522 may be at least partially retracted from the aperture 532 such that the blocking pin does not block the recesses 516 between the threads 514.

The biasing mechanism 524 may comprise a spring (e.g., a coil spring), which may be coupled at a first end 534 to a divider wall 536 at least partially separating the connector 502 from the chamber 508 in which the product 509 may be stored. Although not illustrated, apertures for air flow therethrough, terminals for electric connection, and/or other components may be provided at and through the divider wall 536 such that connection with a control body may allow for operation as described above. In one embodiment, the first end 534 of the biasing mechanism 524 may be

received through an aperture 538 in the divider wall 534. A second end 540 of the biasing mechanism 524 may be coupled to the blocking pin 522. For example, the second end 540 of the biasing mechanism 524 may be received through an aperture 542 defined through the blocking pin 522.

5 The release mechanism 526 may comprise a latch 544 and a release pin 546. The latch 544 may be configured to engage the blocking pin 522 and retain the blocking pin in the retracted position. For example, the latch 544 may comprise a first end defining an extension 548 configured to engage the head 530 of the blocking pin 522. A second end of the latch 544 may comprise a hinge 550 that is coupled to the divider wall 536. Alternatively, the latch 544 may be formed from
10 a bendable material that allows the latch to bend and pivot.

As illustrated in FIG. 5, the connector 502 may be configured to engage a mating connector 552 (e.g., a control body projection) of a control body 554, or other smoking article or portion thereof. The release mechanism 526 may be configured to release the blocking pin 522 after the threads 514 and recesses 516 of the connector 502 engage corresponding threads 556 and recesses
15 558 of the mating connector 552.

In this regard, the release pin 546 may be configured to release the latch 544 from engagement with the blocking pin 522. More particularly, an end 560 of the mating connector 552, or a thread 556 thereof proximate the end, may press against a first end 562 of the release pin 546 when the threads 514 and recesses 516 of the connector 502 engage the threads 556 and recesses
20 558 of the mating connector during attachment of the connector to the mating connector. Accordingly, the release pin 546 may be displaced inwardly toward the chamber 508.

Note that although the release pin 546 is illustrated as being received in an aperture 564 which extends through the threads 514 (see, e.g., FIG. 3), the release pin may extend into the aperture 564 a relatively short distance such that the release pin does not block any of the recesses
25 516 defined by the connector 502, and thereby the mating connector 552 may fully engage the threads 514 and recesses 516 thereof. However, in an alternate embodiment, as illustrated in phantom in FIG. 3, an alternate embodiment of a release pin 546' and a corresponding aperture 564' may not extend through the threads 514. Thereby, issues with respect to the release pin preventing the mating connector 552 from fully engaging the connector 502 may be avoided in a
30 variety of manners.

As the release pin 546 is displaced toward the chamber 508, a tapered end 566 of the release pin may engage the latch 544. The tapered end 566 may be configured to reduce the possibility of binding between the latch 544 and the release pin 546 that may occur if the release pin were to include a blunt end with a sharp edge that engages the latch. By engaging the latch 544, the release

pin 546 may pivot the latch out of contact with the head 530 of the blocking pin 522 either by pivoting the latch about the hinge 550 or by bending the latch.

Accordingly, the biasing mechanism 524 may bias the blocking pin 522 against the end 560 of the mating connector 552 (or a thread 556 thereof proximate the end). Thus, as the connector 502 of the cartridge 500 is unscrewed from the mating connector 552 of the control body 554, the
5 blocking pin 522 may extend outwardly into the cavity 518 of the connector 502, until the blocking pin reaches an extended position, as illustrated in FIG. 6. In this regard, a user may remove the cartridge 500 from the control body 554 after the product 509 in the chamber 508 has been expended through use.

As illustrated in FIG. 7, which is a partially cut-away view through the body 512 of the
10 cartridge 500 along line 7-7 in FIG. 3, in the extended position the blocking pin 522 may extend through the aperture 532 in the body 512 and block at least one of the recesses 516. For example, in the illustrated embodiment recesses 516a-c are blocked. Accordingly, if a user were to attempt to engage the cartridge 500 with the control body 554 for a second time, the blocking pin 522
15 would prevent re-engagement therewith. More particularly, the blocking pin 522 would prevent the threads 558 of the mating connector 552 from engaging the recesses 516a-c of the connector 502, such that the cartridge 500 may not fully engage the control body 554. Thereby, the cartridge may not establish electrical connections, and/or the other connections described above between a control body and a cartridge, such that the cartridge may not be reused.

Note that the aperture 532 may not extend all the way through to the distal attachment end
20 504 of the body 512 in all embodiments. In this regard, the aperture 532 may extend a short distance past the end of the blocking pin 522 in the extended position (e.g., with the aperture extending one or two threads past the last recess 516c blocked by the blocking pin). This embodiment may be preferable because it may hide the aperture 532 from view.

As noted above, in one embodiment of the present disclosure, the single-use connector may
25 include threads and recesses defined at an inner surface of a body. Thus, the connector may be referred to as a female connector. However, in another embodiment of the disclosure the single-use connector may be referred to as a male connector.

In this regard, FIGS. 8-11 illustrate an alternate embodiment of a single-use cartridge 600.
30 The cartridge 600 illustrated in FIGS. 8-11 may be substantially similar to the cartridge 500 illustrated in FIGS. 3-8, with the exception of the external, instead of internal, configuration of the threads and recesses of the connector. Accordingly, the cartridge 600 will not be described in detail.

Briefly, however, FIG. 8 illustrates a view of a connector 602 at a distal attachment end 604 of the cartridge 600. A chamber 608 may be provided at an opposing end of the cartridge 600 (see, e.g., FIG. 9). As illustrated, the connector 602 may include a body 612 comprising a plurality of threads 614 and a plurality of recesses 616 respectively positioned between the threads. The threads 614 and recesses 616 are defined at an outer surface of the body 612 and may surround a cavity 618 in some embodiments. The threads 614 and recesses 616 may be received in a cavity defined by a mating connector of a control body during connection therewith. The connector 602 also includes a single-use mechanism 620.

FIG. 9 illustrates a partially cut-away view through the body 612 of the cartridge 600 along line 9-9 in FIG. 8. As illustrated in FIG. 9, the single-use mechanism 620 may comprise a blocking pin 622, a biasing mechanism 624, and a release mechanism 626. As described above, the blocking pin 622 may be configurable between a retracted position (see, e.g., FIG. 9) and an extended position (see, e.g., FIG. 10). The biasing mechanism 624 may be configured to bias the blocking pin 622 toward the extended position. The blocking pin 622 may be received in an aperture 632 extending through one or more of the threads 614.

The release mechanism 626 may be configured to retain the blocking pin 622 in a retracted position and release the blocking pin after the threads 614 and recesses 616 of the connector 602 engage a mating connector. In this regard, the release mechanism 616 may comprise a latch 644 that is released from engagement with the blocking pin 622 by a release pin 646 after the threads 614 and recesses 616 of the connector 602 engage corresponding threads and recesses of a mating connector. Accordingly, as illustrated in FIG. 10, which is a partially cut-away view through the body 612 of the cartridge 600 along line 10-10 in FIG. 8, the blocking pin 622 may be displaced by the biasing mechanism 624 to an extended position in which the blocking pin extends through the aperture 632 and blocks at least one of the recesses 616. Thereby, reuse of the cartridge 600 may be resisted as described above. As described above, although illustrated as extending to the distal attachment end 604, in other embodiments the aperture 632 may not extend all the way to the distal attachment end in order to at least partially hide the aperture from a user's view in some embodiments.

Note also that various other embodiments of single-use mechanisms employing blocking pins that extend through one or more threads of a connector after use thereof may be employed in the embodiments of single-use cartridges described herein. In this regard, the embodiments of biasing and release mechanisms described herein are provided for example purposes only. Further, although the connectors including single-use mechanisms are generally described herein as defining portions of cartridges configured for connection to control bodies, in other embodiments

the connectors including single-use mechanisms may comprise portions of control bodies. In this regard, in some embodiments it may be desirable to prevent re-use of a control body. Accordingly, it should be understood that the particular embodiments of connectors with single-use mechanisms described above are provided for example purposes only.

- 5 A method for assembling a connector is also provided. As illustrated in FIG. 11, the method may include providing a body at operation 700. The body may define a plurality of threads, a plurality of recesses, and an aperture extending through one or more of the threads. The method may additionally include providing a single-use mechanism at operation 702. The single-use mechanism may comprise a blocking pin, a release mechanism, and a biasing mechanism.
- 10 Further, the method may include coupling the single-use mechanism to the body at operation 704. Coupling the single-use mechanism to the body at operation 704 may be conducted such that the blocking pin is in a retracted position wherein the blocking pin is at least partially retracted from the aperture by the release mechanism, wherein upon disengagement of the threads and recesses from a mating connector the release mechanism releases the blocking pin and the biasing
- 15 mechanism biases the blocking pin to an extended configuration in which the blocking pin extends through the aperture and blocks at least one of the recesses.

In some embodiments coupling the single-use mechanism to the body at operation 704 may comprise coupling a coil spring to the body and the blocking pin. Coupling the single-use mechanism to the body at operation 704 may further comprise retracting the blocking pin to the

20 retracted position and engaging the blocking pin with a latch. Coupling the single-use mechanism to the body at operation 704 may additionally include positioning a release pin in an extended position configured to engage the mating connector and release the latch from the blocking pin upon engagement therewith.

Although the cartridge and the control body can be provided together as a complete

25 smoking article or medicament delivery article generally, the components also may be provided separately. For example, the disclosure also encompasses a disposable cartridge unit for use with a reusable smoking article or a reusable medicament delivery article (e.g., a smoking article control body).

In another aspect, the disclosure can be directed to kits that provide a variety of components

30 as described herein. For example, a kit can comprise a control body with one or more cartridges. A kit further can comprise a control body with one or more charging components. A kit further can comprise a control body with one or more batteries. A kit further may comprise a control body with one or more cartridges and one or more charging components and/or one or more batteries. In further embodiments, a kit may comprise a plurality of cartridges. A kit further may comprise a

plurality of cartridges and one or more batteries and/or one or more charging components. The kits further can include a case (or other packaging, carrying, or storage component) that accommodates one or more of the further kit components. The case could be a reusable hard or soft container. Further, the case could be simply a box or other packaging structure.

- 5 Many modifications and other embodiments of the disclosure will come to mind to one skilled in the art to which this disclosure pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the disclosure is not to be limited to the specific embodiments disclosed herein and that modifications and other embodiments are intended to be included within the scope of the appended claims.
- 10 Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS:

1. A single-use connector, comprising:
a body, defining:
a plurality of threads;
a plurality of recesses respectively positioned between the threads; and
5 an aperture extending through one or more of the threads; and
a single-use mechanism, comprising:
a blocking pin configurable between a retracted position in which the blocking pin is
at least partially retracted from the aperture and an extended position in which the blocking pin
extends through the aperture and blocks at least one of the recesses;
10 a biasing mechanism configured to bias the blocking pin toward the extended
position; and
a release mechanism configured to retain the blocking pin in the retracted position
and release the blocking pin after the threads and the recesses engage a mating connector.
15
2. The single-use connector of Claim 1, wherein the threads and the recesses are
defined at an inner surface of the body surrounding a cavity configured to receive the mating
connector.
3. The single-use connector of Claim 1, wherein the threads and the recesses are
20 defined at an outer surface of the body and configured to be received in a cavity defined by the
mating connector.
4. The single-use connector of any one of Claims 1 to 3, wherein the release
mechanism comprises:
25 a latch configured to engage the blocking pin to retain the blocking pin in the retracted
position; and
a release pin configured to release the latch from engagement with the blocking pin.
5. The single-use connector of Claim 4, wherein the blocking pin defines a head and
30 the latch is configured to engage the head of the blocking pin and pivot out of contact therewith
upon being displaced by the release pin.

6. The single-use connector of Claim 5, wherein the release pin defines a tapered end configured to engage the latch.

7. The single-use connector of Claim 6, wherein the release pin is configured to engage an end of the mating connector when the threads and the recesses engage the mating connector.

8. The single-use connector of any one of Claims 1 to 3, wherein the biasing mechanism comprises a coil spring.

9. A single-use cartridge, comprising:
a chamber configured to hold a product; and
a connector, comprising:
a body, defining:
a plurality of threads;
a plurality of recesses respectively positioned between the threads; and
an aperture extending through one or more of the threads; and
a single-use mechanism, comprising:
a blocking pin configurable between a retracted position in which the blocking pin is at least partially retracted from the aperture and an extended position in which the blocking pin extends through the aperture and blocks at least one of the recesses;
a biasing mechanism configured to bias the blocking pin toward the extended position; and
a release mechanism configured to retain the blocking pin in the retracted position and release the blocking pin after the threads and the recesses engage a mating connector.

10. The single-use cartridge of Claim 9, wherein the threads and the recesses are defined at an inner surface of the body surrounding a cavity configured to receive the mating connector.

11. The single-use cartridge of Claim 9, wherein the threads and the recesses are defined at an outer surface of the body and configured to be received in a cavity defined by the mating connector.

12. The single-use cartridge of any one of Claims 9 to 11, wherein the release mechanism comprises:

a latch configured to engage the blocking pin to retain the blocking pin in the retracted position; and

a release pin configured to release the latch from engagement with the blocking pin.

5 13. The single-use cartridge of Claim 12, wherein the blocking pin defines a head and the latch is configured to engage the head of the blocking pin and pivot out of contact therewith upon being displaced by the release pin.

10 14. The single-use cartridge of Claim 13, wherein the release pin defines a tapered end configured to engage the latch.

 15. The single-use cartridge of Claim 14, wherein the release pin is configured to engage an end of the mating connector when the threads and the recesses engage the mating connector.

15 16. The single-use cartridge of any one of Claims 9 to 11, wherein the biasing mechanism comprises a coil spring.

 17. The single-use cartridge of any one of Claims 9 to 11, wherein the product
20 comprises an aerosol precursor composition.

 18. An electronic smoking article comprising the single-use cartridge of any one of Claims 9 to 11.

25 19. A method for assembling a connector, comprising:
 providing a body defining a plurality of threads, a plurality of recesses, and an aperture extending through one or more of the threads;
 providing a single-use mechanism comprising a blocking pin, a release mechanism, and a
 biasing mechanism;
30 coupling the single-use mechanism to the body such that the blocking pin is in a retracted position wherein the blocking pin is at least partially retracted from the aperture by the release mechanism, wherein upon disengagement of the threads and recesses from a mating connector the release mechanism releases the blocking pin and the biasing mechanism biases the blocking pin to

an extended configuration in which the blocking pin extends through the aperture and blocks at least one of the recesses.

20. The method of Claim 19, wherein coupling the single-use mechanism to the body
5 comprises coupling a coil spring to the body and the blocking pin.

21. The method of Claim 20, wherein coupling the single-use mechanism to the body
further comprises retracting the blocking pin to the retracted position and engaging the blocking pin
with a latch.

10

22. The method of Claim 21, wherein coupling the single-use mechanism to the body
further comprises positioning a release pin in an extended position configured to engage the mating
connector and release the latch from the blocking pin upon engagement therewith.

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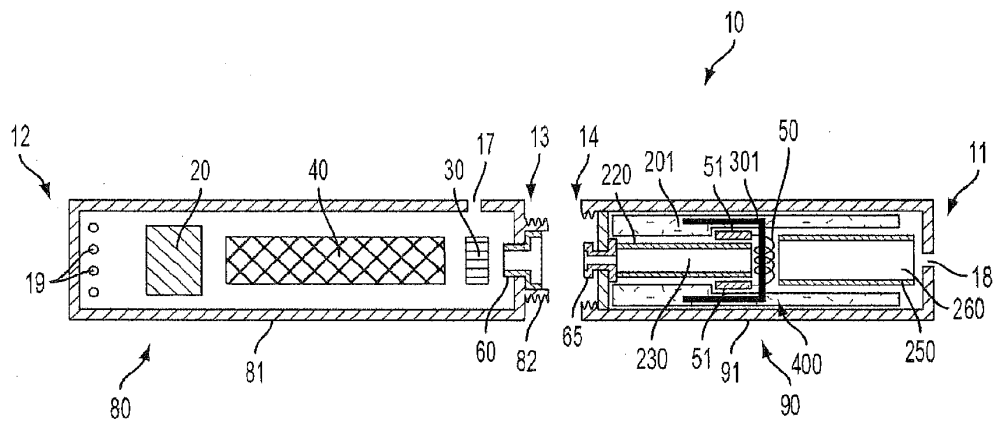


FIG. 1

2 / 11

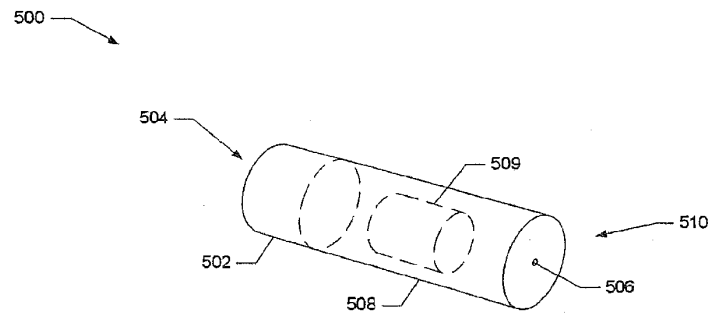
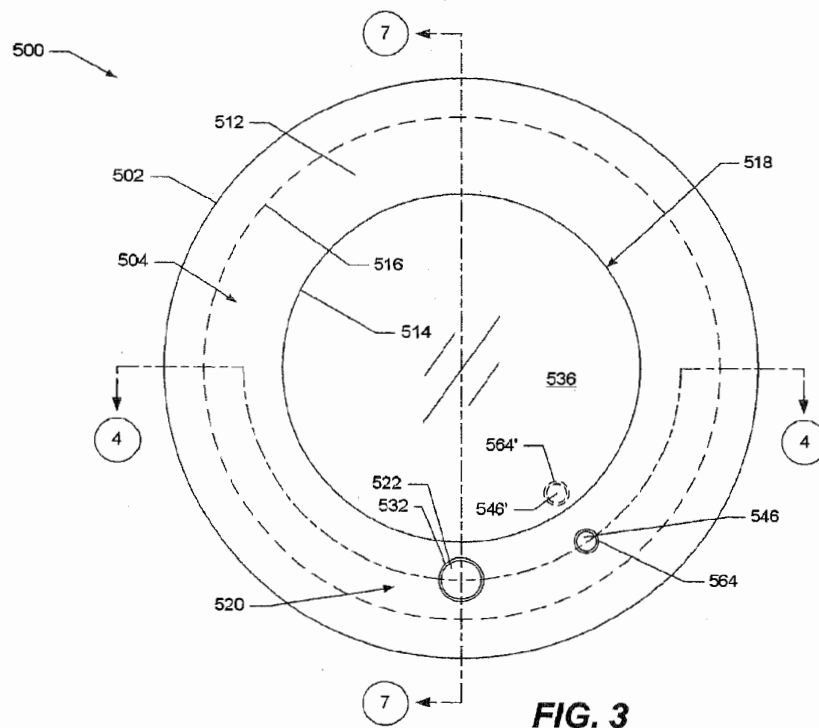


FIG. 2

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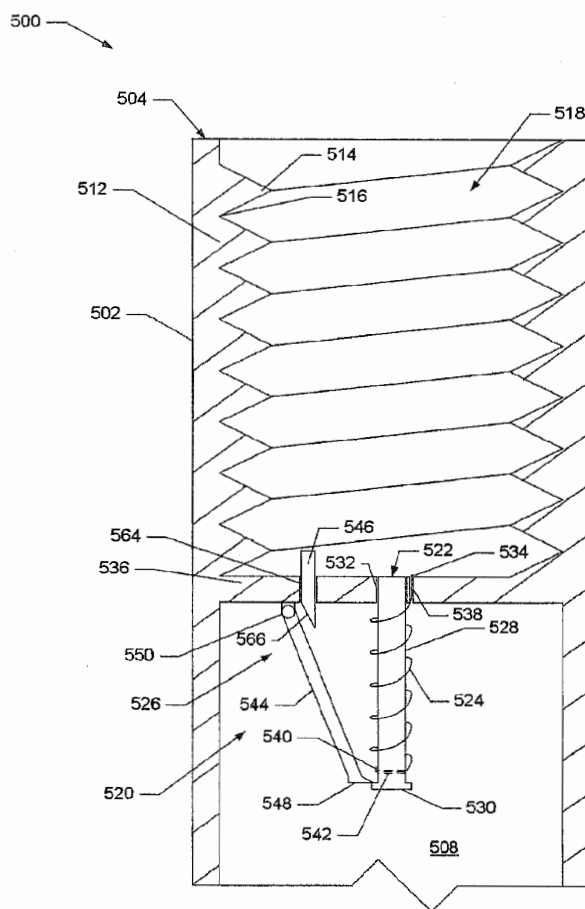


FIG. 4

5 / 11

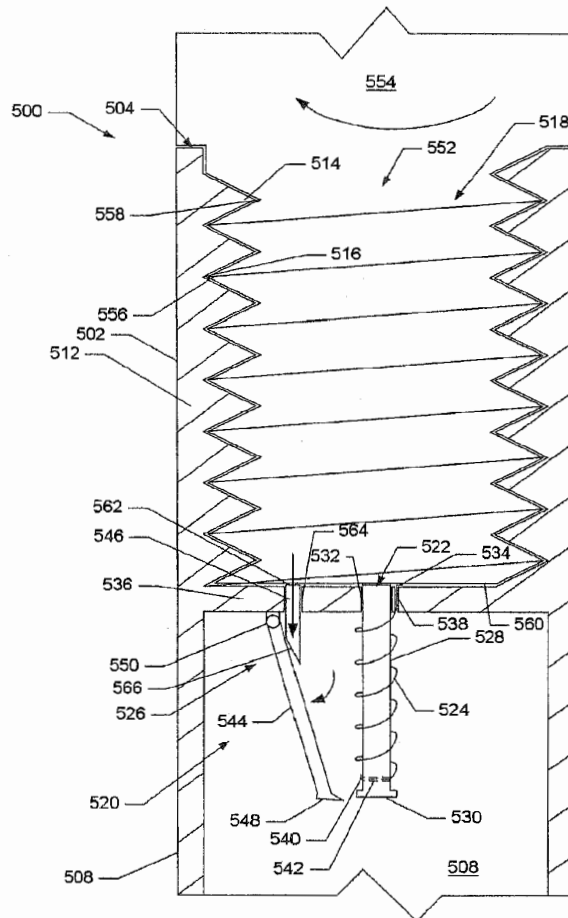


FIG. 5

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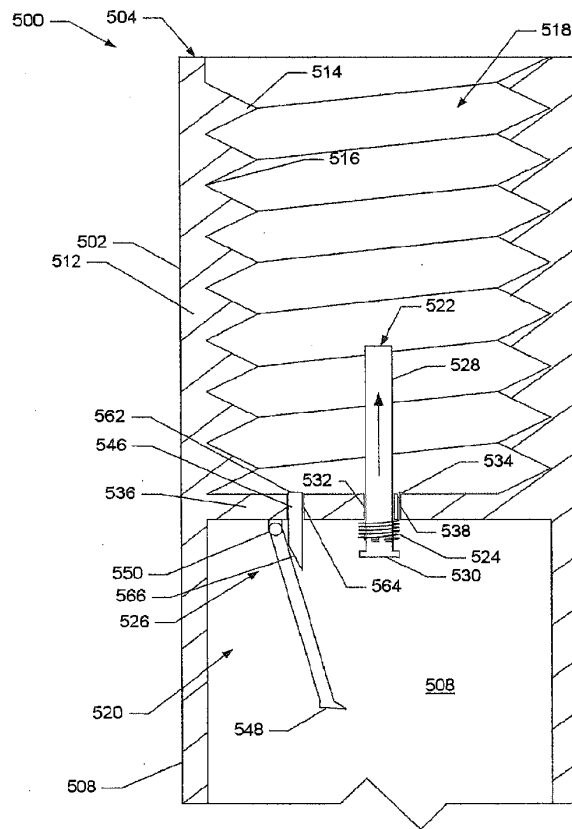
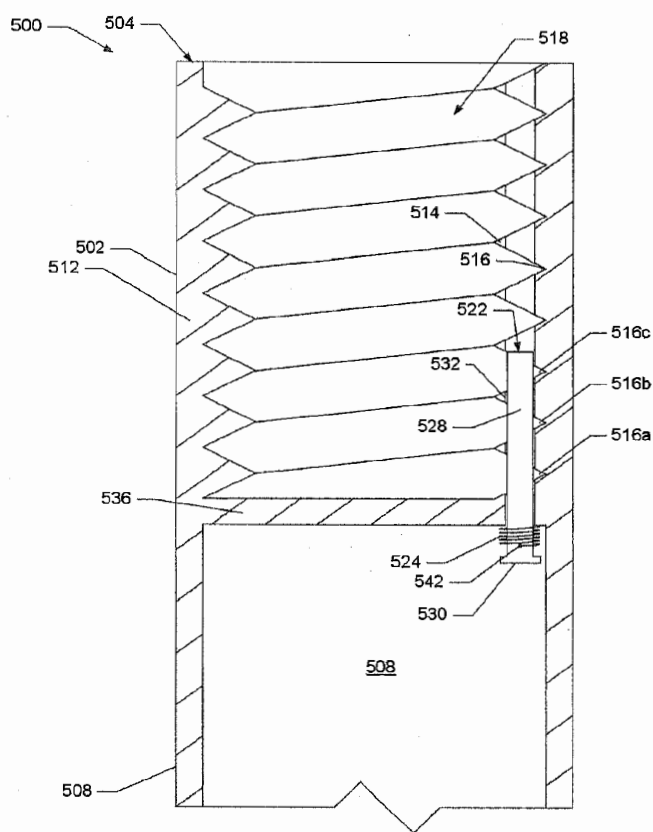


FIG. 6

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**FIG. 7**

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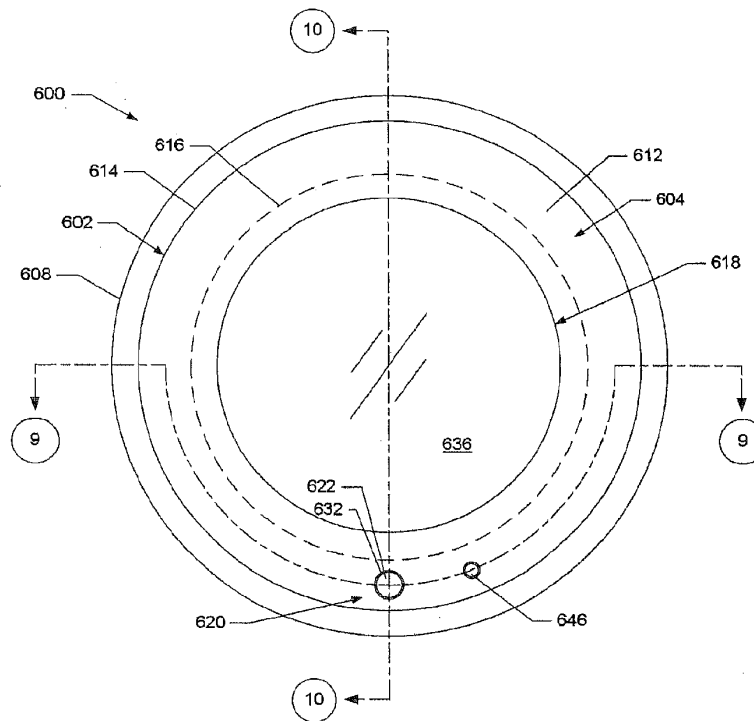


FIG. 8

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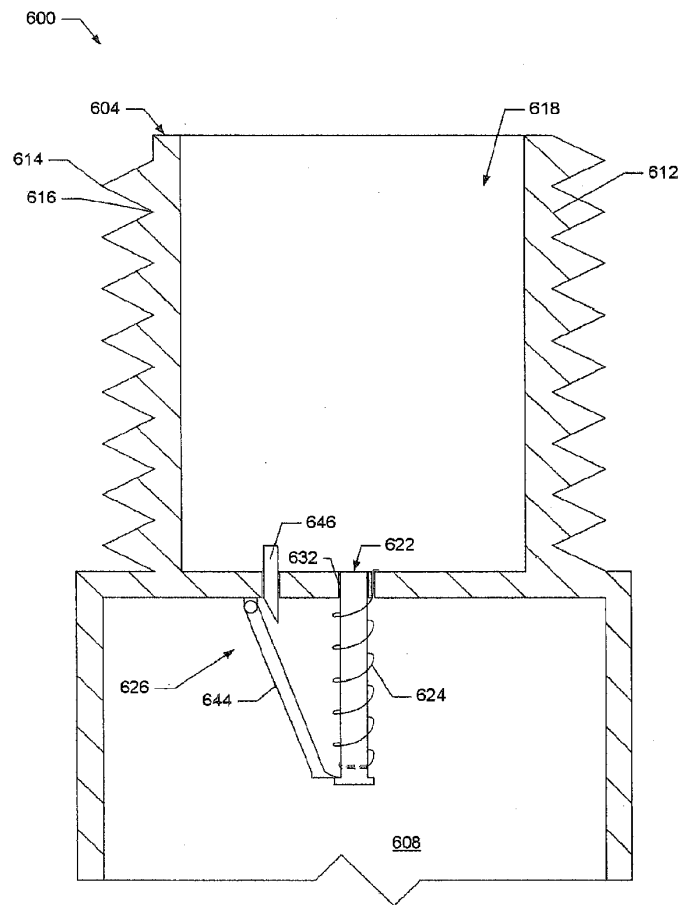


FIG. 9

10 / 11

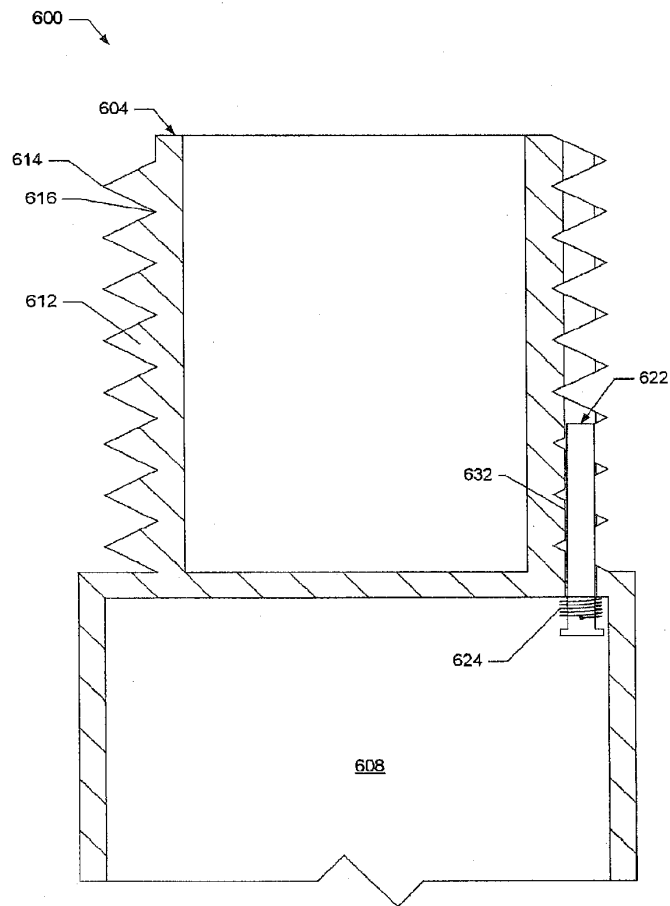


FIG. 10

11 / 11

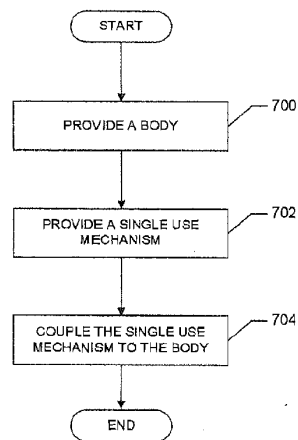


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/056639

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 F16B

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010/200008 A1 (TAIEB ELI [US]) 12 August 2010 (2010-08-12) paragraphs [0021] - [0023]; figures -----	1-22
A	US 2011/277760 A1 (TERRY NATHAN ANDREW [US] ET AL) 17 November 2011 (2011-11-17) paragraphs [0131] - [0134]; figures 1,8,65 -----	1-22
A	US 5 326 207 A (CERNY ALEXANDER [CA]) 5 July 1994 (1994-07-05) the whole document -----	1-22
A	US 922 543 A (TRUSTON SAMUEL [US]) 25 May 1909 (1909-05-25) the whole document -----	1-22



Further documents are listed in the continuation of Box C.



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

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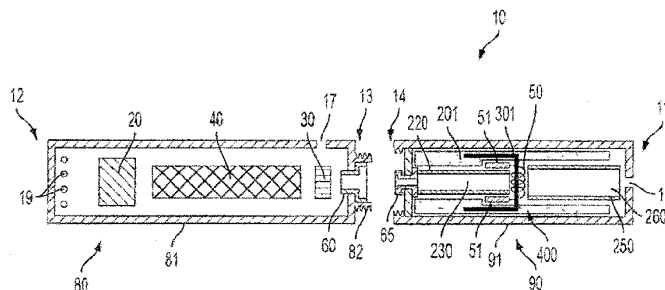


Fig. 1

(57) Abstract: The present disclosure relates to aerosol forming devices (10), such as electronic smoking articles, which can be adapted to detect the status of a cartridge portion of the smoking article, such as by identifying the status of a fusible link. The smoking article can include a control body portion (80) having a control body engagement end, wherein the control body portion houses a control component (20) and a power source (40) therein, and further can include a cartridge body portion (90) having a cartridge body engagement end configured to removably engage the control body engagement end of the control body portion (80). The cartridge body portion (90) can comprise a consumable arrangement and a heating connection operably engaged therewith comprising at least one heating element (50) and a fusible link (160).

NJOY Exhibit 1002.2561

SPENT CARTRIDGE DETECTION METHOD AND SYSTEM FOR
AN ELECTRONIC SMOKING ARTICLE

FIELD OF THE INVENTION

The present invention relates to detecting a status of a cartridge in aerosol delivery articles used for yielding tobacco components or other materials in an inhalable form. Specifically, a detection system is capable of indicating whether a cartridge is used or unused.

5

BACKGROUND OF THE INVENTION

Many smoking devices have been proposed through the years as improvements upon, or alternatives to, smoking products that require combusting tobacco for use. Many of those devices purportedly have been designed to provide the sensations associated with cigarette, cigar, or pipe smoking, but without delivering considerable quantities of incomplete combustion and pyrolysis products that result from the burning of tobacco. To this end, there have been proposed numerous smoking products, flavor generators, and medicinal inhalers that utilize electrical energy to vaporize or heat a volatile material, or attempt to provide the sensations of cigarette, cigar, or pipe smoking without burning tobacco to a significant degree. See, for example, the various alternative smoking articles, aerosol delivery devices and heat generating sources set forth in the background art described in U.S. Pat. No. 7,726,320 to Robinson et al., US Pat. Pat. Pub. No. 2013/0255702 to Griffith Jr., et al., US Pat. Pub. No. 2014/0000638 to Sebastian et al., US Pat. App. Ser. No. 13/602,871, filed September 4, 2012, and US Pat. App. Ser. No. 13/647,000, filed October 8, 2012, which are incorporated herein by reference.

Certain tobacco products that have employed electrical energy to produce heat for smoke or aerosol formation, and in particular, certain products that have been referred to as electronic cigarette products, have been commercially available throughout the world. Representative products that resemble many of the attributes of traditional types of cigarettes, cigars or pipes have been marketed as ACCORD[®] by Philip Morris Incorporated; ALPHA[™], JOYE 510[™] and M4[™] by InnoVapor LLC; CIRRUS[™] and FLING[™] by White Cloud Cigarettes; COHITA[™], COLIBRI[™], ELITE CLASSIC[™], MAGNUM[™], PHANTOM[™] and SENSE[™] by Epuffer[®] International Inc.; DUOPRO[™], STORM[™] and VAPORKING[®] by Electronic Cigarettes, Inc.; EGAR[™] by Egar Australia; eGo-C[™] and eGo-T[™] by Joyetech; ELUSION[™] by Elusion UK Ltd; EONSMOKE[®] by Eonsmoke LLC; GREEN SMOKE[®] by Green Smoke Inc. USA; GREENARETTE[™] by Greenarette LLC; HALLIGAN[™], HENDU[™], JET[™], MAXXQ[™], PINK[™] and PITBULL[™] by Smoke Stik[®]; HEATBAR[™] by Philip Morris International, Inc.;

HYDRO IMPERIAL™ and LXETM from Crown7; LOGICTM and THE CUBAN™ by LOGIC Technology; LUCI® by Luciano Smokes Inc.; METRO® by Nicotek, LLC; NJOY® and ONEJOY™ by Sottera, Inc.; NO. 7™ by SS Choice LLC; PREMIUM ELECTRONIC CIGARETTE™ by PremiumEstore LLC; RAPP E-MYSTICK™ by Ruyan America, Inc.; RED DRAGON™ by Red Dragon Products, LLC; RUYAN® by Ruyan Group (Holdings) Ltd.; SMART SMOKER® by The Smart Smoking Electronic Cigarette Company Ltd.; SMOKE ASSIST® by Coastline Products LLC; SMOKING EVERYWHERE® by Smoking Everywhere, Inc.; V2CIGSTM by VMR Products LLC; VAPOR NINE™ by VaporNine LLC; VAPOR4LIFE® by Vapor 4 Life, Inc.; VEPPOTM by E-CigaretteDirect, LLC and VUSE® by R. J. Reynolds Vapor Company. Yet other electrically powered aerosol delivery devices, and in particular those devices that have been characterized as so-called electronic cigarettes, have been marketed under the tradenames BLUTM; COOLER VISIONSTM; DIRECT E-CIGTM; DRAGONFLY™; EMISTM; EVERSMOKETM; GAMUCCI®; HYBRID FLAMETM; KNIGHT STICKSTM; ROYAL BLUESTM; SMOKETIP® and SOUTH BEACH SMOKETM.

It would be desirable to provide a smoking article that employs heat produced by electrical energy to provide the sensations of cigarette, cigar, or pipe smoking, that does so without combusting tobacco to any significant degree, that does so without the need of a combustion heat source, and that does so without necessarily delivering considerable quantities of incomplete combustion and pyrolysis products.

BRIEF SUMMARY OF THE DISCLOSURE

The above and other needs are met by the present disclosure which, in one aspect, provides a smoking article adapted to detect the status of a cartridge portion of the smoking article. The smoking article includes a control body portion having a control body engagement end, wherein the control body portion houses a control component and a power source therein. The article further comprises a cartridge body portion that includes a cartridge body engagement end configured to removably engage the control body engagement end of the control body portion. In various embodiments, cartridge body portion houses a consumable arrangement and a heating connection operably engaged therewith comprising at least one heating element and a fusible link.

In various embodiments of the present smoking article, the power source is selected from the group consisting of a battery, a capacitor, and combinations thereof. In specific embodiments of the article, the heating element is a resistance heating element. In specific embodiments of the article, the fusible link is an electrical fusible link. Alternatively, the fusible link can be a mechanical fusible link – i.e., can include a mechanical mechanism adapted for breaking the fusible

link under certain pre-determined conditions. In various embodiments of the smoking article, the heating element and the fusible link are electrically aligned in parallel arrangement. Furthermore, the fusible link can be adapted to fail under electrical conditions (e.g., an electrical current of defined voltage and duration) sufficient to cause heating of the heating element.

5 In various embodiments of the smoking article, the heating connection comprising a fusible link and a heating element is in electrical connection with the power source and the control component when the control body and the cartridge body are engaged with one another. The control component can comprise a microcontroller. Furthermore, the control component can be configured to selectively actuate a first electrical current flow of a first set of conditions from the power source to the heating connection when the control body and the cartridge body are engaged, wherein the conditions of the first electrical current flow are insufficient to initiate heating by the heating element. The first set of conditions can comprise a voltage that is substantially the same as a voltage that defines a working voltage for the heating element and a current flow duration of about 45 milliseconds or less (e.g., about 5 milliseconds to about 25 milliseconds). The working voltage can be about 2 volts to about 6 volts.

The control component can be configured to selectively actuate a second electrical current flow of a second set of conditions from the power source to the heating connection, the conditions of said second electrical current flow being sufficient to initiate heating by the heating element. In various embodiments of the smoking article, the conditions of the second electrical current flow can be sufficient to cause the fusible link to fail. In some embodiments of the smoking article of the present disclosure, the conditions of the second electrical current flow can comprise a voltage that is greater than the nominal voltage of the first electrical current flow. In some embodiments, the conditions of the second electrical current flow can be approximately identical to the conditions of the first electrical current flow; however, the second electrical current flow can flow for a time duration that is sufficient to exceed a current flow time at which the fusible link is adapted to fail.

Various embodiments of the smoking article further comprise a current sense resistor, wherein the current sense resistor is adapted to establish an indication of the fusible link status. The control component can be further configured to initiate a command function based upon a cartridge status interpreted from the fusible link status indicated by the current sense resistor. Specifically, the current sense resistor can be adapted to sense a first resistance across the fusible link and a second resistance across the heating element. Sensing of the first resistance can be indicative of an unused cartridge. Sensing of the second resistance in the absence of the first resistance can be indicative of a used cartridge.

Various embodiments of the cartridge body further comprise a consumable arrangement in communication with the heating element. The consumable arrangement can comprise an aerosol precursor composition. In specific embodiments, the aerosol precursor composition is selected from the group consisting of a polyhydric alcohol, a medicament, a tobacco component, a tobacco-derived material, a flavorant, and combinations thereof. In specific embodiments, the polyhydric alcohol is selected from the group consisting of glycerin, propylene glycol, and combinations thereof. In various embodiments, the consumable arrangement comprises a substrate and an aerosol precursor composition, wherein the aerosol precursor composition is one of coated on, adsorbed by, and absorbed in at least a portion of the substrate.

The present disclosure also describes methods of detecting a status of a cartridge portion of a smoking article. Various embodiments of a cartridge status detection method comprise providing a control body comprising a control component and a power source, providing a cartridge body comprising a heating connection comprising a heating element and a fusible link, and removably engaging the cartridge body with the control body such that the heating connection is in electrical connection with the power source and the control component. The method further comprises establishment of a first electrical current flow from the power source to the heating connection and the control component, wherein the control component is configured to interpret the cartridge status based upon the first electrical current flowing through the heating connection. Similar aspects of the smoking article discussed above are provided in the cartridge status detection methods, as discussed in more detail below.

The invention includes, without limitation, the following embodiments:

Embodiment 1: A smoking article, comprising: a power source; a control component adapted to control power delivery from the power source; and a heating connection comprising a heating element and a fusible link.

Embodiment 2: A smoking article of any preceding or subsequent embodiment, wherein a control body houses the power source and the control component, wherein a cartridge body houses the heating connection, and wherein the cartridge body is configured to removably engage the control body.

Embodiment 3: A smoking article of any preceding or subsequent embodiment, wherein the power source is selected from the group consisting of a battery, a capacitor, and combinations thereof.

Embodiment 4: A smoking article of any preceding or subsequent embodiment, wherein the heating element is a resistance heating element.

Embodiment 5: A smoking article of any preceding or subsequent embodiment, wherein the fusible link is an electrical fusible link.

Embodiment 6: A smoking article of any preceding or subsequent embodiment, wherein the fusible link is a mechanical fusible link.

5 Embodiment 7: A smoking article of any preceding or subsequent embodiment, wherein the fusible link is adapted to fail under electrical conditions sufficient to initiate heating by the heating element.

Embodiment 8: A smoking article of any preceding or subsequent embodiment, wherein the fusible link and the heating element are electrically aligned in parallel arrangement.

10 Embodiment 9: A smoking article of any preceding or subsequent embodiment, wherein the heating connection, the power source, and the control component define a closed electrical circuit when the control body and the cartridge body are engaged.

Embodiment 10: A smoking article of any preceding or subsequent embodiment, wherein the control component is configured to selectively actuate a first electrical current flow of a first set
15 of conditions from the power source to the heating connection, said first electrical current flow being insufficient to initiate heating by the heating element.

Embodiment 11: A smoking article of any preceding or subsequent embodiment, wherein the first set of conditions comprises a voltage that is substantially the same as a voltage that defines a working voltage for the heating element and a current flow duration of about 45 milliseconds or
20 less.

Embodiment 12: A smoking article of any preceding or subsequent embodiment, wherein the current flow duration is about 5 milliseconds to about 25 milliseconds.

Embodiment 13: A smoking article of any preceding or subsequent embodiment, wherein the working voltage is about 2 volts to about 6 volts.

25 Embodiment 14: A smoking article of any preceding or subsequent embodiment, wherein the electrical circuit further comprises a current sense resistor.

Embodiment 15: A smoking article of any preceding or subsequent embodiment, wherein the current sense resistor is adapted to measure a value that is indicative of the fusible link status.

Embodiment 16: A smoking article of any preceding or subsequent embodiment, wherein
30 the control component is adapted to initiate a logic sequence based upon a value received from the current sense resistor.

Embodiment 17: A smoking article of any preceding or subsequent embodiment, wherein, based upon the logic sequence, the control component either allows normal use of the cartridge

engaging the control body or temporarily disables the control body until engaging with a different cartridge.

Embodiment 18: A smoking article of any preceding or subsequent embodiment, wherein the control component is configured to selectively actuate a second electrical current flow of a second set of conditions from the power source to the heating connection, said second electrical current flow being sufficient to initiate heating by the heating element.

Embodiment 19: A smoking article of any preceding or subsequent embodiment, wherein the second electrical current flow is applied for a time duration that exceeds a current flow time at which the fusible link is adapted to fail.

Embodiment 20: A smoking article of any preceding or subsequent embodiment, wherein the control component comprises a microcontroller.

Embodiment 21: A smoking article of any preceding or subsequent embodiment, wherein the cartridge body further comprises a consumable arrangement in communication with the heating element.

Embodiment 22: A smoking article of any preceding or subsequent embodiment, wherein the consumable arrangement comprises an aerosol precursor composition.

Embodiment 23: A smoking article of any preceding or subsequent embodiment, wherein the aerosol precursor composition is selected from the group consisting of a polyhydric alcohol, a medicament, a tobacco component, a tobacco-derived material, a flavorant, and combinations thereof.

Embodiment 24: A smoking article of any preceding or subsequent embodiment, wherein the polyhydric alcohol is selected from the group consisting of glycerin, propylene glycol, and combinations thereof.

Embodiment 25: A smoking article of any preceding or subsequent embodiment, wherein the consumable arrangement comprises a substrate and an aerosol precursor composition, and wherein the aerosol precursor composition is one of coated on, adsorbed by, and absorbed in at least a portion of the substrate.

Embodiment 26: A method of detecting a status of a cartridge in a smoking article, comprising: providing a control body comprising a control component and a power source; providing a cartridge body comprising a heating connection comprising a heating element and a fusible link; and removably engaging the cartridge body with the control body so as to establish a closed electrical circuit comprising the heating connection, the power source, and the control component, and so as to cause the control component to initiate a first electrical current flow of a first set of conditions from the power source to the heating connection, wherein the control

component identifies a cartridge status based upon a characteristic of the first electrical current flowing through the electrical circuit.

Embodiment 27: A method of any preceding or subsequent embodiment, wherein the power source is selected from the group consisting of a battery, a capacitor, and combinations thereof.

5 Embodiment 28: A method of any preceding or subsequent embodiment, wherein the closed electrical circuit further comprises a current sense resistor positioned in one of the control body and the cartridge.

Embodiment 29: A method of any preceding or subsequent embodiment, wherein the current sense resistor measures the characteristic of the first electrical current and relays the
10 measurement to the control component.

Embodiment 30: A method of any preceding or subsequent embodiment, wherein a first value for the characteristic is processed by the control component as being indicative of an intact fusible link and an unused cartridge.

Embodiment 31: A method of any preceding or subsequent embodiment, wherein a second
15 value for the characteristic is processed by the control component as being indicative of a failed fusible link and a used cartridge.

Embodiment 32: A method of any preceding or subsequent embodiment, wherein the conditions of the first electrical current flow are insufficient to initiate heating of the heating element.

20 Embodiment 33: A method of any preceding or subsequent embodiment, wherein the control component comprises a microcontroller.

Embodiment 34: A method of any preceding or subsequent embodiment, wherein the cartridge body comprises a consumable arrangement in communication with the heating element.

Embodiment 35: A method of any preceding or subsequent embodiment, wherein the
25 consumable arrangement comprises an aerosol precursor composition.

Embodiment 36: A method of any preceding or subsequent embodiment, wherein the aerosol precursor composition is selected from the group consisting of a polyhydric alcohol, a medicament, a tobacco component, a tobacco-derived material, a flavorant, and combinations thereof.

30 Embodiment 37: A method of any preceding or subsequent embodiment, wherein the polyhydric alcohol is selected from the group consisting of glycerin, propylene glycol, and combinations thereof.

Embodiment 38: A method of any preceding or subsequent embodiment, wherein the consumable arrangement comprises a substrate and an aerosol precursor composition, and wherein

the aerosol precursor composition is one of coated on, adsorbed by, and absorbed in at least a portion of the substrate.

These and other features, aspects, and advantages of the disclosure will be apparent from a reading of the following detailed description together with the accompanying drawings, which are briefly described below. The invention includes any combination of two, three, four, or more of the above-noted embodiments as well as combinations of any two, three, four, or more features or elements set forth in this disclosure, regardless of whether such features or elements are expressly combined in a specific embodiment description herein. This disclosure is intended to be read holistically such that any separable features or elements of the disclosed invention, in any of its various aspects and embodiments, should be viewed as intended to be combinable unless the context clearly dictates otherwise

BRIEF DESCRIPTION OF THE FIGURES

Having thus described the invention in the foregoing general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 is a perspective view of an example embodiment of a smoking article according to the disclosure, wherein a portion of an outer shell of the article is cut away to reveal the interior components thereof;

FIG. 2 is a block diagram of an example embodiment of a cartridge detection system according to the disclosure;

FIG. 3 is a flow diagram of an example embodiment of a method of detecting a status of a cartridge in a smoking article; and

FIG. 4 is a logic flow chart that is exemplary of a decision pathway utilized by the control component to identify cartridge status in a smoking article.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will now be described more fully hereinafter with reference to exemplary embodiments thereof. These exemplary embodiments are described so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. As used in the specification, and in the appended claims, the singular forms "a", "an", "the", include plural referents unless the context clearly dictates otherwise.

The present disclosure relates to articles (and the manufacture thereof) that use electrical energy to heat a material (preferably without combusting the material to any significant degree) to form an inhalable substance, the articles being sufficiently compact to be considered "hand-held" devices. In certain embodiments, the articles can particularly be characterized as smoking articles.

5 As used herein, the term "smoking article" is intended to mean an article that provides many of the sensations (e.g., inhalation and exhalation rituals, types of tastes or flavors, organoleptic effects, physical feel, use rituals, visual cues such as those provided by visible aerosol, and the like) of smoking a cigarette, cigar, or pipe without any substantial degree of combustion of any component of the article. As used herein, the term "smoking article" does not necessarily mean that, in
10 operation, the article produces smoke in the sense of the aerosol resulting from by-product of combustion or pyrolysis of tobacco, but rather, that the article yields vapors (including vapors within aerosols that can be considered to be visible aerosols that might be considered to be described as smoke-like) resulting from volatilization or vaporization of certain components of the article or device." In highly preferred embodiments, articles characterized as smoking articles
15 incorporate tobacco and/or components derived from tobacco.

In further embodiments, the articles that can be manufactured according to the present disclosure can be characterized as being vapor-producing articles, aerosolization articles, or medicament delivery articles. Thus, the articles can be arranged so as to provide one or more substances (e.g., flavors and/or pharmaceutical active ingredients) in an inhalable form or state.
20 For example, inhalable substances can be substantially in the form of a vapor (i.e., a substance that is in the gas phase at a temperature lower than its critical point). Alternatively, inhalable substances can be in the form of an aerosol (i.e., a suspension of fine solid particles or liquid droplets in a gas). For purposes of simplicity, the term "aerosol" as used herein is meant to include vapors, gases and aerosols of a form or type suitable for human inhalation, whether or not visible,
25 and whether or not of a form that might be considered to be smoke-like.

In use, smoking articles according to the present disclosure may be subjected to many of the physical actions of an individual in using a traditional type of smoking article (e.g., a cigarette, cigar or pipe that is employed by lighting with a flame and used by inhaling tobacco that is subsequently burned). For example, the user of a smoking article of the present invention can hold
30 that article much like a traditional type of smoking article, draw on one end of that article for inhalation of aerosol produced by that article, take puffs at selected intervals of time.

A smoking article that can be manufactured according to one aspect of the present disclosure can include a number of components provided within an outer shell or body. The overall design of the outer shell or body can vary, and the format or configuration of the outer body that

can define the overall size and shape of the smoking article can vary. Typically, an elongated body resembling shape of a cigarette or cigar can be formed from a single, unitary shell; or the elongated body can be formed of two or more separable pieces. For example, a smoking article can comprise an elongated shell or body that can be substantially tubular in shape, and as such, 5 resemble the shape of a conventional cigarette or cigar. In one embodiment, all of the components of the smoking article are contained within one outer body or shell. Alternatively, a smoking article can comprise two shells that are joined and are separable. For example, a smoking article can possess at one end a control body comprising a shell containing one or more reusable components (e.g., a rechargeable battery and various electronics for controlling the operation of 10 that article), and at the other end and removably attached thereto a shell containing a disposable portion (e.g., a disposable flavor-containing cartridge). Additionally, various smoking article designs and component arrangements can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

15 A smoking article that can be manufactured according to one aspect of the present disclosure can include some combination of power source (i.e., an electrical power source), at least one control component (e.g., means for actuating, controlling, regulating and ceasing power for heat generation, such as by controlling electrical current flow the power source to other components of the article), a heater or heat generation component (e.g., an electrical resistance heating element 20 or component commonly referred to as an "atomizer"), and an aerosol precursor component (e.g., commonly a liquid capable of yielding an aerosol upon application of sufficient heat, such as ingredients commonly referred to as "smoke juice," "e-liquid" and "e-juice"), and a mouthend region or tip for allowing draw upon the smoking article for aerosol inhalation (e.g., a defined air flow path through the article such that aerosol generated can be withdrawn therefrom upon draw).

25 Alignment of the components within the article can vary. In specific embodiments, the aerosol precursor component can be located near an end of the article (e.g., with a cartridge, which in certain circumstances can be replaceable and disposable) that is proximal to the mouth of a user so as to maximize aerosol delivery to the user. Other configurations, however, are not excluded. Generally, the heater component can be positioned sufficiently near that aerosol precursor 30 component so that heat from the heater component can volatilize the aerosol precursor (as well as one or more flavorants, medicaments, or the like that may likewise be provided for delivery to a user) and form an aerosol for delivery to the user. When the heating member heats the aerosol precursor component, an aerosol is formed, released, or generated in a physical form suitable for inhalation by a consumer. It should be noted that the foregoing terms are meant to be

interchangeable such that reference to release, releasing, releases, or released includes form or generate, forming or generating, forms or generates, and formed or generated. Specifically, an inhalable substance is released in the form of a vapor or aerosol or mixture thereof. Additionally, the selection of various smoking article components can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

A smoking article that can be manufactured according to one aspect of the present disclosure can include may incorporate a battery or other electrical power source to provide current flow sufficient to provide various functionalities to the article, such as resistive heating, powering of control systems, powering of indicators, and the like. The power source can take on various embodiments. Preferably, the power source is able to deliver sufficient power to rapidly heat the heating member to provide for aerosol formation and power the article through use for the desired duration of time. The power source preferably is sized to fit conveniently within the article so that the article can be easily handled; and additionally, preferred a preferred power source is of a sufficiently light weight to not detract from a desirable smoking experience.

An exemplary smoking article 10 according to the disclosure is shown in FIG. 1. As seen in the surface illustrated therein, the smoking article 10 can comprise a control body 80 and a cartridge 90 that can be aligned in a functioning relationship. In this regard, the control body 80 and the cartridge 90 may be attachable and detachable from each other. Although a threaded engagement is illustrated in FIG. 1, it is understood that further means of engagement are encompassed, such as a press-fit engagement, a magnetic engagement, or the like. The cartridge can particularly include a single use connector as otherwise described herein.

In specific embodiments, the control body 80 may be referred to as being reusable and the cartridge 90 may be referred to as being disposable. In some embodiments, the entire smoking article may be characterized as being disposable in that the control body may be configured for only a limited number of uses (e.g., until a battery power component no longer provides sufficient power to the smoking article) with a limited number of cartridges and, thereafter, the entire smoking article 10, including the control body, may be discarded. In other embodiments, the control body may have a replaceable battery such that the control body can be reused through a number of battery exchanges and with many cartridges. Similarly, the smoking article 10 may be rechargeable and thus may be combined with any type of recharging technology, including connection to a typical electrical outlet, connection to a car charger (i.e., cigarette lighter receptacle), and connection to a computer, such as through a USB cable.

The control body 80 includes a control component 20, a flow sensor 30, and a battery 40. Although these components are illustrated in a specific alignment, it is understood that various alignments of the components are encompassed by the present disclosure. The control body 80 further includes a plurality of indicators 19 at a distal end 12 of the control body shell 81. Such indicators 19 can show the number of puffs taken or remaining from the smoking article can be indicative of an active or inactive status, can light up in response to a puff, or the like. The indicators can be provided in varying numbers and can take on different shapes and can even be simply an opening in the body (such as for release of sound when such indicators are present).

Various positions for one or more air intakes 17 are encompassed by the present disclosure. As shown, the air intake 17 may be positioned in the control body shell 81 such that air drawn through the intake sufficiently contacts the flow sensor 30 to activate the sensor (although other positions are encompassed, particularly if different sensing means are provided or if manual actuation, such as with a push button, is provided). A receptacle 60 also is included at the proximal attachment end 13 of the control body 80 and extends into the control body projection 82 to allow for ease of electrical connection with the resistive heating element 50 when the cartridge 90 is attached to the control body. In the illustrated embodiment, the receptacle 60 includes a central open passage to facilitate air flow from the air intake in the control body into the cartridge during use of the article 10.

The cartridge 90 includes a cartridge shell 91 with a mouth opening 18 at the mouthend 11 thereof to allow passage of air and entrained vapor (i.e., the components of the aerosol precursor composition in an inhalable form) from the cartridge to a consumer during draw on the smoking article 10. The smoking article 10 according to the present disclosure may have an overall shape that may be defined as being substantially rod-like or substantially tubular shaped or substantially cylindrically shaped. As illustrated in FIG. 1, the smoking article 10 has a substantially round cross-section; however, other cross-sectional shapes (e.g., oval, square, triangle, etc.) also are encompassed by the present disclosure. Such language that is descriptive of the physical shape of the smoking article may also be applied to the individual units of the smoking article in embodiments comprising multiple units, such as a control body and a cartridge.

In preferred embodiments, the smoking article 10 may take on a size that is comparative to a cigarette or cigar shape. Thus, the smoking article may have a diameter of about 5 mm to about 25 mm, about 5 mm to about 20 mm, about 6 mm to about 15 mm, or about 6 mm to about 10 mm. Such dimension may particularly correspond to the outer diameter of the control body shell 81 and/or the cartridge shell 91. The control body can have a length of about 50 mm to about 110 mm, about 60 mm to about 100 mm, or about 65 mm to about 95 mm. The cartridge can have a length

of about 20 mm to about 60 mm, about 25 mm to about 55 mm, or about 30 mm to about 50 mm. The overall length of the combined cartridge and control body (or the overall length of a smoking article according to the disclosure formed of a single, unitary shell) can be approximately equal to or less than the length of a typical cigarette – e.g., about 70 mm to about 130 mm, about 80 mm to about 125 mm, or about 90 mm to about 120 mm.

The cartridge shell 91 of the smoking article 10 can be formed of any material suitable for forming and maintaining an appropriate conformation, such as a tubular shape, and for retaining therein the suitable components of the smoking article. The body can be formed of a single wall, as shown in FIG. 1. The cartridge shell 91 can be formed of a material (natural or synthetic) that is heat resistant so as to retain its structural integrity – e.g., does not degrade – at least at a temperature that is the heating temperature provided by the resistive heating element. In some embodiments, a heat resistant polymer may be used. In other embodiments, the body can be formed from paper, such as a paper that is substantially straw-shaped, or from metal, such as stainless steel. As further discussed herein, the body, such as a paper tube, may have one or more layers associated therewith that function to substantially prevent movement of vapor therethrough. In one example, an aluminum foil layer may be laminated to one surface of the body. Ceramic materials also may be used.

The cartridge 90 further includes a resistive heating element 50 in the form of a metal wire coil. The resistive heating element includes terminals 51 (e.g., positive and negative terminals) at the opposing ends thereof for facilitating current flow through the resistive heating element and for attachment of the appropriate wiring (not illustrated) to form an electrical connection of the resistive heating element with the battery 40 when the cartridge 90 is connected to the control body 80. Specifically, a plug 65 is positioned at the distal attachment end 14 of the cartridge. When the cartridge 90 is connected to the control body 80, the plug 65 engages the receptacle 60 to form an electrical connection such that current controllably flows from the battery 40, through the receptacle and plug, and to the resistive heating element 50. The cartridge shell 91 can continue across the distal attachment end such that this end of the cartridge is substantially closed with the plug protruding therefrom. As illustrated in FIG. 1, the plug 65 includes an open central passage that aligns with the open central passage in the receptacle 60 to allow air to flow from the control body 80 and into the cartridge 90.

Generally, in use, when a consumer draws on the mouthend 11 of the cartridge, the flow sensor 30 detects the change in flow and activates the control component 20 to facilitate current flow through the resistive heating element 50. Thus, it is useful for air flow to travel through the control body 80 in a manner that flow sensor 30 detects air flow almost instantaneously.

The control algorithm may call for power to the resistive heating element 50 to cycle and thus maintain a defined temperature. The control algorithm therefore can be programmed to automatically deactivate the smoking article 10 and discontinue power flow through the smoking article after a defined time lapse without a puff by a consumer. Moreover, the smoking article can include a temperature sensor to provide feedback to the control component. Such sensor can be, for example, in direct contact with the resistive heating element 50. Alternative temperature sensing means likewise may be used, such as relying upon logic control components to evaluate resistance through the resistive heating element and correlate such resistance to the temperature of the element. In other embodiments, the flow sensor 30 may be replaced by appropriate components to provide alternative sensing means, such as capacitive sensing. Still further, one or more control buttons can be included to allow for manual actuation by a consumer to elicit a variety of functions, such as powering the article 10 on and off, turning on the heating element 50 to generate a vapor or aerosol for inhalation, or the like.

When the flow sensor 30 is positioned within the control body 80, it can be useful to have an air intake 17 on the control body. If desired, a sealed flow path can be provided such that the flow sensor 30 within the control body 80 is in fluid connection with the cartridge interior after the cartridge and the control body are engaged, such fluid connection being sealed with respect to the remainder of the components within the control body but opening into the cartridge 90 when attached to the control body. Further, in other embodiments, the flow sensor 30 can be located within the cartridge 90 instead of the control body 80.

A reservoir may utilize a transport element to transport an aerosol precursor composition to an aerosolization zone. As used herein, the term "reservoir" refers to a receptacle or chamber for holding, storing, or retaining a product such as a liquid, fluid, or aerosol. One such example is shown in FIG. 1. As seen therein, the cartridge 90 includes a reservoir layer 201 comprising layers of nonwoven fibers formed into the shape of a tube encircling the interior of the cartridge shell 91, in this embodiment. An aerosol precursor composition is retained in the reservoir layer 201. Liquid components, for example, can be sorptively retained by the reservoir layer 201. The reservoir layer 201 is in fluid connection with a transport element 301 (a wick in this embodiment). The transport element 301 transports the aerosol precursor composition stored in the reservoir layer 201 via capillary action to an aerosolization zone 400 of the cartridge 90. As illustrated, the transport element 301 is in direct contact with the resistive heating element 50 that is in the form of a metal wire coil in this embodiment.

In use, when a user draws on the article 10, the resistive heating element 50 is activated (e.g., such as via a puff sensor), and the components for the aerosol precursor composition are

vaporized in the aerosolization zone 400. Drawing upon the mouthend 11 of the article 10 causes ambient air to enter the air intake 17 and pass through the central opening in the receptacle 60 and the central opening in the plug 65. In the cartridge 90, the drawn air passes through an air passage 230 in an air passage tube 220 and combines with the formed vapor in the aerosolization zone 400 to form an aerosol. The aerosol is whisked away from the aerosolization zone, passes through an air passage 260 in an air passage tube 250, and out the mouth opening 18 in the mouthend 11 of the article 10. If desired, the air passage tube 250 can be absent, and an open cavity may reside in the location for formation of aerosol as the aerosol precursor composition is vaporized by the resistive heating element 50.

The smoking article 10 in the embodiment illustrated in FIG. 1 can be characterized as a disposable article. Accordingly, it can be desirable for the reservoir 201 in such embodiments to include a sufficient amount of aerosol precursor composition and any further inhalable materials so that a consumer can obtain more than a single use of the smoking article. For example, the smoking article can include sufficient aerosolizable and/or inhalable materials such that the smoking article can provide a number of puffs substantially equivalent to the number of puffs (of about two seconds duration) available from a plurality of conventional cigarettes – e.g., 2 or more, 5 or more, 10 or more, or 20 or more conventional cigarettes. More particularly, a disposable, single unit article according to the embodiment of FIG. 1 can provide about 20 or more, about 50 or more, or about 100 or more puffs.

Although FIG. 1 is illustrative of a smoking article according to the present disclosure, the scope of the disclosure should not be viewed as being limited to the specific combination and/or arrangement of components illustrated therein. Rather, the present disclosure can encompass a variety of combinations of components useful in forming an electronic smoking article. Reference is made for example to the smoking articles disclosed in US Pat. Pub. No. 2014/0000638 to Sebastian et al., and US Pat. Pub. No. 2013/0255702 to Griffith Jr., et al., the disclosures of which are incorporated herein by reference in their entirety. Further to the above, representative heating element and materials for use therein are described in US Pat. No. 5,060,671 to Counts et al.; US Pat. No. 5,093,894 to Deevi et al.; 5,224,498 to Deevi et al.; 5,228,460 to Sprinkel Jr., et al.; 5,322,075 to Deevi et al.; US Pat. No. 5,353,813 to Deevi et al.; US Pat. No. 5,468,936 to Deevi et al.; US Pat. No. 5,498,850 to Das; US Pat. No. 5,659,656 to Das; US Pat. No. 5,498,855 to Deevi et al.; US Pat. No. 5,530,225 to Hajaligol; US Pat. No. 5,665,262 to Hajaligol; US Pat. No. 5,573,692 to Das et al.; and US Pat. No. 5,591,368 to Fleischhauer et al., the disclosures of which are incorporated herein by reference in their entirety.

The various components of a smoking article according to the present invention can be chosen from components described in the art and commercially available. Examples of batteries that can be used according to the disclosure are described in US Pub. App. No. 2010/0028766, the disclosure of which is incorporated herein by reference in its entirety.

5 An exemplary mechanism that can provide puff-actuation capability includes a Model 163PC01D36 silicon sensor, manufactured by the MicroSwitch division of Honeywell, Inc., Freeport, Ill. Further examples of demand-operated electrical switches that may be employed in a heating circuit according to the present disclosure are described in US Pat. No. 4,735,217 to Gerth et al., which is incorporated herein by reference in its entirety. Further description of current
10 regulating circuits and other control components, including microcontrollers, that can be useful in the present smoking article are provided in US Pat. Nos. 4,922,901, 4,947,874, and 4,947,875, all to Brooks et al., US Pat. No. 5,372,148 to McCafferty et al., US Pat. No. 6,040,560 to Fleischhauer et al., and US Pat. No. 7,040,314 to Nguyen et al., all incorporated by reference in their entireties.

 The aerosol precursor composition or vapor precursor composition, can comprise one or
15 more different components. For example, the aerosol precursor can include a polyhydric alcohol (e.g., glycerin, propylene glycol, or a mixture thereof). Representative types of further aerosol precursor compositions are set forth in US Pat. No. 4,793,365 to Sensabaugh, Jr. et al.; US Pat. No. 5,101,839 to Jakob et al.; PCT WO 98/57556 to Biggs et al.; and Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company
20 Monograph (1988); the disclosures of which are incorporated herein by reference.

 Aerosol precursor compositions can include further liquid materials, such as water. For example, aerosol precursor compositions can incorporate mixtures of glycerin and water, or mixtures of propylene glycol and water, or mixtures of propylene glycol and glycerin, or mixtures of propylene glycol, glycerin, and water. Exemplary aerosol precursor compositions also include
25 those types of materials incorporated within devices available through Atlanta Imports Inc., Acworth, Ga., USA., as an electronic cigar having the brand name E-CIG, which can be employed using associated Smoking Cartridges Type C1a, C2a, C3a, C4a, C1b, C2b, C3b and C4b; and as Ruyan Atomizing Electronic Pipe and Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd., Beijing, China.

30 The aerosol precursor composition used in the disclosed smoking article further can comprise one or more flavors, medicaments, or other inhalable materials. For example, liquid nicotine can be used. Such further materials can comprise one or more components of the aerosol precursor or vapor precursor composition. Thus, the aerosol precursor or vapor precursor composition can be described as comprising an inhalable substance. Such inhalable substance can

include flavors, medicaments, and other materials as discussed herein. Particularly, an inhalable substance delivered using a smoking article according to the present invention can comprise a tobacco component or a tobacco-derived material. Alternately, the flavor, medicament, or other inhalable material can be provided separate from other aerosol precursor components – e.g., in a reservoir. As such, defined aliquots of the flavor, medicament, or other inhalable material may be separately or simultaneously delivered to the resistive heating element to release the flavor, medicament, or other inhalable material into an air stream to be inhaled by a user along with the further components of the aerosol precursor or vapor precursor composition.

A wide variety of types of flavoring agents, or materials that alter the sensory or organoleptic character or nature of the mainstream aerosol of the smoking article can be employed. Such flavoring agents can be provided from sources other than tobacco, can be natural or artificial in nature, and can be employed as concentrates or flavor packages. Of particular interest are flavoring agents that are applied to, or incorporated within, those regions of the smoking article where aerosol is generated. Again, such agents can be supplied directly to the resistive heating element or may be provided on a substrate as already noted above. Exemplary flavoring agents include vanillin, ethyl vanillin, cream, tea, coffee, fruit (e.g., apple, cherry, strawberry, peach and citrus flavors, including lime and lemon), maple, menthol, mint, peppermint, spearmint, wintergreen, nutmeg, clove, lavender, cardamom, ginger, honey, anise, sage, cinnamon, sandalwood, jasmine, cascarilla, cocoa, licorice, and flavorings and flavor packages of the type and character traditionally used for the flavoring of cigarette, cigar, and pipe tobaccos. Syrups, such as high fructose corn syrup, also can be employed. Flavoring agents also can include acidic or basic characteristics (e.g., organic acids, such as levulinic acid, succinic acid, lactic acid, and pyruvic acid). The flavoring agents can be combined with the aerosol-generating material if desired. Exemplary plant-derived compositions that may be used are disclosed in US App. No. 12/971,746 to Dube et al. and US App. No. 13/015,744 to Dube et al., the disclosures of which are incorporated herein by reference in their entireties.

Organic acids particularly may be incorporated into the aerosol precursor to provide desirable alterations to the flavor, sensation, or organoleptic properties of medicaments, such as nicotine, that may be combined with the aerosol precursor. For example, organic acids, such as levulinic acid, succinic acid, lactic acid, and pyruvic acid, may be included in the aerosol precursor with nicotine in amounts up to being equimolar (based on total organic acid content) with the nicotine. Any combination of organic acids can be used. For example, the aerosol precursor can include about 0.1 to about 0.5 moles of levulinic acid per one mole of nicotine, about 0.1 to about 0.5 moles of pyruvic acid per one mole of nicotine, about 0.1 to about 0.5 moles of lactic acid per

one mole of nicotine, or combinations thereof, up to a concentration wherein the total amount of organic acid present is equimolar to the total amount of nicotine present in the aerosol precursor.

In embodiments of the aerosol precursor material that contain a tobacco extract, including pharmaceutical grade nicotine derived from tobacco, it is advantageous for the tobacco extract to be characterized as substantially free of compounds collectively known as Hoffmann analytes, including, for example, tobacco-specific nitrosamines (TSNAs), including N'-nitrosornicotine (NNN), (4-methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N'-nitrosoanatabine (NAT), and N'-nitrosoanabasine (NAB); polyaromatic hydrocarbons (PAHs), including benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene, and the like. In certain embodiments, the aerosol precursor material can be characterized as completely free of any Hoffmann analytes, including TSNAs and PAHs.

Embodiments of the aerosol precursor material may have TSNA levels (or other Hoffmann analyte levels) in the range of less than about 5 ppm, less than about 3 ppm, less than about 1 ppm, or less than about 0.1 ppm, or even below any detectable limit. Certain extraction processes or treatment processes can be used to achieve reductions in Hoffmann analyte concentration. For example, a tobacco extract can be brought into contact with an imprinted polymer or non-imprinted polymer such as described, for example, in US Pat. Pub. Nos. 2007/0186940 to Bhattacharyya et al; 2011/0041859 to Rees et al.; 2011/0159160 to Jonsson et al; and 2012/0291793 to Byrd et al., all of which are incorporated herein by reference. Further, the tobacco extract could be treated with ion exchange materials having amine functionality, which can remove certain aldehydes and other compounds. See, for example, US Pat. Nos. 4,033,361 to Horsewell et al. and 6,779,529 to Figlar et al., which are incorporated herein by reference in their entireties.

In certain embodiments, the aerosol precursor can be adapted to increase in surface area during heating for aerosol formation in an electronic smoking article. In particular, the aerosol precursor can comprise an effervescent material. The effervescent material can be adapted to degrade during heating and release carbon dioxide (or other gaseous substance) sufficient to cause foaming of at least a portion of the aerosol precursor or to produce fine droplets. Inclusion of such effervescent can be beneficial to reduce the amount of heat needed to form an aerosol from the aerosol precursor.

The aerosol precursor composition may take on a variety of conformations based upon the various amounts of materials utilized therein. For example, a useful aerosol precursor composition may comprise up to about 98% by weight up to about 95% by weight, or up to about 90% by weight of a polyol. This total amount can be split in any combination between two or more different polyols. For example, one polyol can comprise about 50% to about 90%, about 60% to

about 90%, or about 75% to about 90% by weight of the aerosol precursor, and a second polyol can comprise about 2% to about 45%, about 2% to about 25%, or about 2% to about 10% by weight of the aerosol precursor. A useful aerosol precursor also can comprise up to about 25% by weight, about 20% by weight or about 15% by weight water – particularly about 2% to about 25%, about 5% to about 20%, or about 7% to about 15% by weight water. Flavors and the like (which can include medicaments, such as nicotine) can comprise up to about 10%, up to about 8%, or up to about 5% by weight of the aerosol precursor.

As a non-limiting example, an aerosol precursor according to the invention can comprise glycerol, propylene glycol, water, nicotine, and one or more flavors. Specifically, the glycerol can be present in an amount of about 70% to about 90% by weight, about 70% to about 85% by weight, or about 75% to about 85% by weight, the propylene glycol can be present in an amount of about 1% to about 10% by weight, about 1% to about 8% by weight, or about 2% to about 6% by weight, the water can be present in an amount of about 10% to about 20% by weight, about 10% to about 18% by weight, or about 12% to about 16% by weight, the nicotine can be present in an amount of about 0.1% to about 5% by weight, about 0.5% to about 4% by weight, or about 1% to about 3% by weight, and the flavors can be present in an amount of up to about 5% by weight, up to about 3% by weight, or up to about 1% by weight, all amounts being based on the total weight of the aerosol precursor. One specific, non-limiting example of an aerosol precursor comprises about 75% to about 80% by weight glycerol, about 13% to about 15% by weight water, about 4% to about 6% by weight propylene glycol, about 2% to about 3% by weight nicotine, and about 0.1% to about 0.5% by weight flavors. The nicotine, for example, can be from a tobacco extract.

The amount of aerosol precursor composition that is used within the smoking article is such that the article exhibits acceptable sensory and organoleptic properties, and desirable performance characteristics. For example, it is highly preferred that sufficient aerosol precursor composition components, such as glycerin and/or propylene glycol, be employed in order to provide for the generation of a visible mainstream aerosol that in many regards resembles the appearance of tobacco smoke. Typically, the amount of aerosol-generating material incorporated into the smoking article is in the range of about 1.5 g or less, about 1 g or less, or about 0.5 g or less. The amount of aerosol precursor composition can be dependent upon factors such as the number of puffs desired per cartridge used with the smoking article. It is desirable for the aerosol precursor composition not to introduce significant degrees of unacceptable off-taste, filmy mouth-feel, or an overall sensory experience that is significantly different from that of a traditional type of cigarette that generates mainstream smoke by burning tobacco cut filler. The selection of the particular aerosol-generating material and reservoir material, the amounts of those components used, and the

types of tobacco material used, can be altered in order to control the overall chemical composition of the mainstream aerosol produced by the smoking article.

Still further components can be utilized in the smoking article of the present disclosure. For example, US 5,261,424 to Sprinkel, Jr. discloses piezoelectric sensors that can be associated with the mouth-end of a device to detect user lip activity associated with taking a draw and then trigger heating; US 5,372,148 to McCafferty et al. discloses a puff sensor for controlling energy flow into a heating load array in response to pressure drop through a mouthpiece; US 5,967,148 to Harris et al. discloses receptacles in a smoking device that include an identifier that detects a non-uniformity in infrared transmissivity of an inserted component and a controller that executes a detection routine as the component is inserted into the receptacle; US 6,040,560 to Fleischhauer et al. describes a defined executable power cycle with multiple differential phases; US 5,934,289 to Watkins et al. discloses photonic-optronic components; US 5,954,979 to Counts et al. discloses means for altering draw resistance through a smoking device; US 6,803,545 to Blake et al. discloses specific battery configurations for use in smoking devices; US 7,293,565 to Griffen et al. discloses various charging systems for use with smoking devices; US 2009/0320863 by Fernando et al. discloses computer interfacing means for smoking devices to facilitate charging and allow computer control of the device; US 2010/0163063 by Fernando et al. discloses identification systems for smoking devices; and WO 2010/003480 by Flick discloses a fluid flow sensing system indicative of a puff in an aerosol generating system; all of the foregoing disclosures being incorporated herein by reference in their entireties. Further examples of components related to electronic aerosol delivery articles and disclosing materials or components that may be used in the present article include US Pat. No. 4,735,217 to Gerth et al.; US Pat. No. 5,249,586 to Morgan et al.; US Pat. No. 5,666,977 to Higgins et al.; US Pat. No. 6,053,176 to Adams et al.; US 6,164,287 to White; US Pat No. 6,196,218 to Voges; US Pat. No. 6,810,883 to Felter et al.; US Pat. No. 6,854,461 to Nichols; US Pat. No. 7,832,410 to Hon; US Pat. No. 7,513,253 to Kobayashi; US Pat. No. 7,896,006 to Hamano; US Pat. No. 6,772,756 to Shayan; US Pat. Pub. Nos. 2009/0095311, 2006/0196518, 2009/0126745, and 2009/0188490 to Hon; US Pat. Pub. No. 2009/0272379 to Thorens et al.; US Pat. Pub. Nos. 2009/0260641 and 2009/0260642 to Monsees et al.; US Pat. Pub. Nos. 2008/0149118 and 2010/0024834 to Oglesby et al.; US Pat. Pub. No. 2010/0307518 to Wang; and WO 2010/091593 to Hon. A variety of the materials disclosed by the foregoing documents may be incorporated into the present devices in various embodiments, and all of the foregoing disclosures are incorporated herein by reference in their entireties.

Although an article according to the disclosure may take on a variety of embodiments, as discussed in detail below, the use of the article by a consumer will be similar in scope. In

particular, the article can be provided as a single unit or as a plurality of components that are combined by the consumer for use and then are dismantled by the consumer thereafter. Generally, a smoking article according to the disclosure can comprise a first unit that is engagable and disengagable with a second unit, the first unit comprising the resistive heating element, and the second unit comprising the electrical power source. In some embodiments, the second unit further can comprise one or more control components that actuate or regulate current flow from the electrical power source. The first unit can comprise a distal end that engages the second unit and an opposing, proximate end that includes a mouthpiece (or simply the mouthend) with an opening at a proximate end thereof. The first unit can comprise an air flow path opening into the mouthpiece of the first unit, and the air flow path can provide for passage of aerosol formed from the resistive heating element into the mouthpiece. In preferred embodiments, the first unit can be disposable. Likewise, the second unit can be reusable.

During use, the consumer initiates heating of the resistive heating element, the heat produced by the resistive heating element aerosolizes the aerosol precursor composition and, optionally, further inhalable substances. Such heating releases at least a portion of the aerosol precursor composition in the form of an aerosol (which can include any further inhalable substances included therewith), and such aerosol is provided within a space inside the cartridge that is in fluid communication with the mouthend of the cartridge. When the consumer inhales on the mouth end of the cartridge, air is drawn through the cartridge, and the combination of the drawn air and the aerosol is inhaled by the consumer as the drawn materials exit the mouth end of the cartridge (and any optional mouthpiece present) into the mouth of the consumer. To initiate heating, the consumer may actuate a pushbutton, capacitive sensor, or similar component that causes the resistive heating element to receive electrical energy from the battery or other energy source (such as a capacitor). The electrical energy may be supplied for a pre-determined length of time or may be manually controlled. Preferably, flow of electrical energy does not substantially proceed in between puffs on the article (although energy flow may proceed to maintain a baseline temperature greater than ambient temperature – e.g., a temperature that facilitates rapid heating to the active heating temperature). In further embodiments, heating may be initiated by the puffing action of the consumer through use of various sensors, as otherwise described herein. Once the puff is discontinued, heating will stop or be reduced. When the consumer has taken a sufficient number of puffs so as to have released a sufficient amount of the inhalable substance (e.g., an amount sufficient to equate to a typical smoking experience), the cartridge can be removed from the control housing and discarded. Indication that the cartridge is spent (i.e., the aerosol precursor composition has been substantially removed by the consumer) can be provided. In some

embodiments, a single cartridge can provide more than a single smoking experience and thus may provide a sufficient content of aerosol precursor composition to simulate as much as a full pack of conventional cigarettes or even more.

Smoking articles useful according to the invention can further comprise one or more
5 components adapted to detect a cartridge status. Various embodiments of the smoking article can include a heating connection comprising a heating element and a fusible link. The term “fusible link” as used herein refers to a component adapted to fail under defined conditions and thus function as a sacrificial device in a cartridge status detection system. The heating connection is preferably in electrical connection with the power source of the smoking article such that electrical
10 energy can be provided to the heating connection. In various embodiments, the heating connection is in electrical connection with a component adapted to measure the current flow, voltage, and/or the resistance across the heating connection. Specific embodiments of the smoking article can include a control component adapted to interpret the cartridge status based upon the measured current, voltage and/or resistance across the heating connection.

15 In particular embodiments, the smoking article can include components that define an electrical circuit whereby a control component is configured to controllably deliver a low power pulse from the power source to the heating connection according to one or more defined algorithms. As a non-limiting example, the control algorithm can include pulse width modulation, which can be based on comparison of a battery voltage with a lookup table. As a further non-
20 limiting example, the control algorithm can include a constant voltage feedback loop, such as through utilization of heater voltage measurements. Specifically, in various embodiments of the smoking article, appropriate wiring can be included such that a cartridge engaging a control body defines a closed electrical circuit through which the control component can controllably deliver a low power pulse (as well as a higher power pulse). The low power pulse can be defined as an
25 electrical current that does not exceed the limits of a fusible link as described herein. By contrast, the higher power electrical current that defines a working status of the heating element (i.e., wherein the heating element heats to a temperature sufficient to vaporize the aerosol precursor material) can exceed the limits of the fusible link.

In some embodiments, a low power pulse can have a voltage, a current, or both that is
30 substantially similar to the same property of the higher power pulse, and pulse power can be defined by current flow duration. In particular, time can be adjusted such that the average power delivered to the circuit is constrained appropriately. In certain embodiments, the fusible link can exhibit a resistance that is lower than the resistance of the heating element. In some embodiments, the fusible link and the heating element are provided in parallel, a majority of the current entering

the closed circuit can preferentially flow through the fusible link. When the duration of the electrical current flow is sufficiently long, the lower resistance fusible link will fail and thus allow all of the delivered current to pass through the heating element. Depending upon the type of material from which the fusible link is formed, a sufficiently long current flow time can be about 50
5 milliseconds or greater, about 100 milliseconds or greater, or about 50 to about 500 milliseconds. In various embodiments, the heating element can require that the current be applied for a time of about 0.5 seconds or greater or about 1 second or greater, particularly about 1 second to about 4 seconds for sufficient heating to occur. Therefore, in some embodiments, conditions defining a low power pulse can comprise a voltage, a current, or both a voltage and a current that is substantially
10 the same as the same corresponding voltage, current, or both that is utilized for normal functioning of the heating element, and can also comprise an active flow unit time of about 45 milliseconds or less or about 25 milliseconds or less, particularly about 5 milliseconds to about 25 milliseconds.

In other embodiments, the low power pulse can be defined by a current and/or voltage that can be less than the current and/or voltage that define the working status of the heating element.
15 For example, the electrical current that defines a working status of the heating element can exceed the current delivered by the low power pulse by a factor of 2 or more, 5 or more, or 10 or more. A voltage that defines a working voltage for the heating element can be about 2 volts to about 6 volts, about 2.5 volts to about 5.5 volts, or about 3 volts to about 5 volts. The working voltage is the voltage at which the heating element sufficiently heats to form the desired amount of aerosol during
20 a current flow time as described above.

A smoking article according to the disclosure further can comprise a component that is adapted to measure one or more of current, voltage, and resistance across the heating connection. For example, a current sense resistor as further described herein can be used. The control component can be adapted to interpret a status of the fusible link based upon a value provided by
25 the current sense resistor or like component. The control component can be adapted to allow or disallow heating of a heating element in the cartridge portion engaging a control portion of the smoking article based upon the value provided by the current sense resistor. The current sense resistor can be adapted to define a first value when the fusible link is intact and thus is in a condition for transmission of the low power pulse. For example, an intact fusible link can be
30 defined by a first measurable resistance of a specific value or value range, and sensing of the first resistance of the defined value or value range by the current sense resistor upon initiation of the low power pulse can cause the current sense resistor to output the value to the control component that is recognized thereby as defining that the cartridge is unused. A fusible link that is not intact can be defined by a second measurable resistance of a specific value or value range, and sensing of the

second resistance of the defined value or value range by the current sense resistor can cause the current sense resistor to output the value to the control component that is recognized thereby as defining that the cartridge is used. The second measurable resistance can be the resistance of the heating element, and sensing of the second measurable resistance can indicate that the cartridge has been used (i.e., the heating connection has previously encountered an electrical current of conditions sufficient to activate the heating element as well as to cause the fusible link to fail).

A configuration as described above can be beneficial to prevent functioning of the control component with a non-matched cartridge (e.g., a cartridge that has been depleted of the aerosol precursor and re-filled and/or a cartridge manufactured by a different entity). Therefore, a control component can be adapted to initiate a command that does not allow for a current flow sufficient to activate the heater to be actuated if the control component interprets the measured resistance as evidence of a failed fusible link and/or a cartridge that does not include a fusible link. Thereby a user can be prevented from using the smoking article if the cartridge has been used prior to engagement of the cartridge and the control body and/or if the cartridge is manufactured by another entity that does not provide a fusible link in the cartridge as contemplated herein.

As described herein, in specific embodiments a fusible link (also referred to as a fuse) can be defined as a component that is adapted to fail (or fuse) when an electrical current of defined sufficient conditions is actuated to flow through a circuit that includes the fusible link. For example, embodiments of the fusible link are adapted to fail under electrical conditions sufficient to initiate heating by the heating element. In some embodiments, the fusible link can be a component adapted to provide a resistance when an electrical current is applied thereto. Preferably, the fusible link exhibits an electrical resistance that is significantly lower than the electrical resistance of the heating element. For example, the ratio of heater element resistance to fusible link resistance can be 1.1 or greater, 1.25 or greater, 1.5 or greater, or 2 or greater. The difference in the resistances can vary based upon the minimum measurable resolution by the current sense resistor and the conversion circuit, material properties, and working conditions. Depending upon the resistance ratio, the unit time of the low power pulse can be varied to ensure that the low power pulse is insufficient to fuse the fusible link. The electrical conditions described herein can be adjusted to meet material demands and working conditions within the bounds of the present disclosure.

Generally, a fusible link can comprise a metal strip or wire fuse element which has a smaller cross-section compared to the circuit conductors (wiring, for example) connecting the rest of an electrical circuit. A fusible link can be mounted between a pair of electrical terminals and in various embodiments, can be enclosed by a non-combustible housing. The fusible link can be adapted to melt directly, for example, when subjected to an electrical current of conditions that

exceed the limits of the fusible link. In other embodiments, a soldered joint within the fusible link can be adapted to melt when subjected to the necessary conditions. A fuse can be adapted to carry a specified current and melt quickly on application of electrical current of the defined conditions.

In specific embodiments, the fusible link is an electrical fusible link. In exemplary
5 embodiments, the electrical fusible link can be defined as a short piece of conductive wire that is at least two, at least three, or at least four American wire gauge sizes smaller than the wire of the circuit that is being protected. In some embodiments, a fusible link can be formed of two pieces of metal soldered together with a fusible alloy that is designed to melt at a specific temperature, thereby allowing the two metal pieces to separate. The term "fusible alloy" as used herein refers to
10 a metal alloy capable of being easily melted at relatively low temperatures (e.g., a temperature that is caused by heating of the fusible link due to being subjected to an electrical current of sufficient conditions to cause the heating element to heat to a desired working temperature). In further embodiments, the fusible link can be a mechanical element, such as a connector pin or further mechanism, that can be mechanically disengaged under conditions of electrical current flow
15 sufficient to enable heating of the heating element.

Various sizes and styles of fusible links can be used in embodiments of the cartridge detection system. In some embodiments, a fusible link is made from zinc, copper, silver, aluminum, a metal alloy, or combinations thereof. The speed at which a fuse blows is dependent on how much current flows through it and the material from which the fuse is made. Fuse bodies
20 (or housing) can be made of ceramic, glass, plastic, fiberglass, molded mica laminates, molded compressed fiber, or other non-conductive materials known in the art. A fusible link useful according to the present disclosure can be defined by specific shapes, sizes, materials, or the like that can provide for desired properties.

In various embodiments, the heating connection is in electrical connection with a
25 component adapted to measure the flow of electrical current across the heating connection. Current can be converted to a voltage reading, which may then be compared with a threshold, digitized, or otherwise processed by a current sense circuit. As a non-limiting example, a circuit can employ a current transformer, a hall-effect sensor, or a magnetoresistive sensor to convert current to a voltage reading. In various embodiments, a current sense resistor is used due to its simplicity and relatively
30 low cost. Such resistors typically have low resistance values, typically less than 50 milliohms (0.050 ohms), for example. A current sensing resistor can be designed for low resistance so as to minimize power consumption. A calibrated resistance can be utilized to sense the current flowing through the current sense resistor in the form of a voltage drop which is detected and monitored by control circuitry. The voltage across the current sensing resistor then can be amplified and

converted to a current value as desired. In specific embodiments, for example, a current sense resistor operating in connection with a control component can be used to measure current across the heating connection. As electrical current flows from the power source to the heating connection a current sense resistor can continuously receive and monitor the amount of current that is coming
5 from both the power source and the heating connection. The heating connection can comprise a fusible link and a heating element which are electrically connected in parallel arrangement. As such, the total resistance of the fusible link and the heating element can be determined and evaluated by the control component to determine whether the fusible link remains intact.

An exemplary embodiment of a smoking article 10 is shown in FIG. 2 and can comprise a
10 cartridge body 90 and a control body 80. In the illustrated embodiment, the control body 80 comprises a power source 40 (e.g., a battery), a control component 20, and a current sense resistor 170. Although FIG. 2 shows the current sense resistor 170 as being located in the control body 80, alternative embodiments have a current sense resistor 170 located in the cartridge body 90. The exact location of the current sense resistor 170 is not limiting to the present invention. Appropriate
15 electrical wiring interconnects the battery 40, control component 20, and current sense resistor 170. The electrical connection between the power source 40 and the control component 20 allows for the control component to be configured to selectively actuate current flow from the electrical power source to other components of the smoking article. The cartridge 90 comprises a heating
20 connection 165 which comprises a heating element 50 and a fusible link 160. The fusible link 160 is electrically aligned in parallel arrangement with the heating element 50. When the control body 80 and the cartridge 90 are engaged with one another, a closed circuit is formed such that the heating connection 165 is in electrical connection with the power source 40, the control component 20 and the current sense resistor 170. The engaged cartridge and control body is operative as otherwise described herein, and the individual components of the smoking article can be defined as
25 otherwise described herein.

In use, a fusible link in a smoking article can be adapted to work in connection with a control component and, optionally, a current sense resistor (or similar component) to detect the status of a cartridge. More particularly, the status that is detectable is whether the cartridge is new (i.e., not previously used) or whether the cartridge has been previously activated such that heating
30 of the heating element has occurred. The control component of the smoking article can process the cartridge status and thus determine whether use of the cartridge is authorized. An authenticated cartridge can be used normally with the engaged control body for aerosol formation. The control component can be adapted to temporarily disable the control body when engaging a non-authorized cartridge but allow normal usage to resume upon engagement with an authenticated cartridge.

An example of a method of detecting a status of a cartridge according to certain embodiments of the present disclosure is illustrated in FIG. 3. As seen therein, such method can comprise providing a control body at operation 400, the control body comprising a control component, a power source, and an optional current sense resistor, and providing a cartridge at
5 operation 405, the cartridge comprising a heating connection which comprises a heating element, a fusible link, and an optional current sense resistor. It is understood that the current sense resistor is present in one of the control body and the cartridge. The current sense resistor is adapted to identify an indication of fusible link status. Specifically, the current sense resistor is adapted to sense a first resistance across the fusible link and a second resistance across the heating element
10 and then relay such information to the control component.

Next, the detection method includes, at operation 410, removably engaging the cartridge with the control body so as to establish a closed circuit including the power source, the control component, the heating connection, and the current sense resistor. The method further includes, at operation 415, actuation by the control component of a low power pulse through the closed circuit.
15 In specific embodiments, this low power pulse is defined by electrical conditions (e.g., voltage and unit time) that are insufficient to initiate heating by the heating element and also are insufficient to fuse the fusible link. For instance, the insufficient electrical conditions can comprise a working voltage applied for a sufficiently short unit time as described herein. In a return leg of the closed circuit, the low power pulse of electrical current flows through the current sense resistor. The
20 detection method then comprises, at operation 420, measuring by the current sense resistor of the electrical current flowing from the heating connection. At operation 425, the method comprises processing the measurements from the current sense resistor through a logic flow wherein use of the cartridge is allowed or disallowed based upon the status of the fusible link. For example, a microcontroller can be adapted to interpret the resistance across the heating connection during the
25 low power pulse so as to determine whether the fuse is intact based on the measured resistance. Sensing of a first resistance can be indicative of an intact fusible link. Sensing of a second resistance can be indicative of a fusible link that is already fused. The recognition of an intact fusible link in a cartridge identifies the cartridge as being an unused cartridge. Optionally, the method as illustrated in FIG. 3 can comprise, at operation 430, initiating a command to authorize
30 functioning of the control body with the engaged cartridge or to temporarily disable the control body until a different cartridge is engaged. An authorization command enables flow of sufficient electrical current to heat the heating element and thus form an aerosol.

Flow of sufficient electrical current to heat the heating element is also sufficient to cause the fusible link to fail. Subsequent samples of the failed fuse utilizing a low power pulse as described herein will be measured and processed so as to indicate a used cartridge.

Illustrated in FIG. 4 is a logic flow chart that is exemplary of a decision pathway 500
5 utilized by a control component to identify cartridge status. At step A, a cartridge body portion and a control body portion can be removably engaged to establish a closed circuit including a power source, a control component, a heating connection, and a current sense resistor. Upon engagement, the control component can initiate a low power pulse across the closed circuit at operation 510. At operation 520, the control component can receive the result of the detected cartridge status. After
10 receiving the result, the control component can initiate one of two or more commands. For example, if the fusible link is intact (i.e., the cartridge is unused), the control component can authorize normal use of the cartridge at operation 530. If the fusible link has failed or is absent (i.e., the cartridge has been used), the control component can temporarily disable the control body at operation 540. At step B, the cartridge body portion and the control body portion are disengaged
15 from one another, such as following full, normal use of a cartridge per pathway operation 530 or following temporary disabling of the control body per pathway 540. Following disengagement, at operation 550 the detection routine is reset. The cartridge body portion is then in condition to be engaged with a cartridge and the logic flow routine can be carried out again. Therefore, any new cartridge body portion engaged with the control body portion will cause the control component to
20 run the subroutine again at point A. As seen above, in various embodiments, the control component is configured to reset when a cartridge is disengaged from the control body and the electrical circuit is interrupted. This allows for the control body to be reused with new cartridges that have been authorized for use according to the method steps described above.

In some embodiments, a similar logic flow can be utilized for sampling of the cartridge by
25 the control body between each puff on the device. For example, after the cartridge has been authenticated, the low power pulse can be initiated between puffs on the device to confirm the working condition of the heater element. The reset of the detection routine at operation 550 after disengagement of the cartridge can still apply in such embodiments.

Although the various figures described herein illustrate the control body and the cartridge in
30 a working relationship, it is understood that the control body and the cartridge can exist as individual devices. Accordingly, any discussion otherwise provided herein in relation to the components in combination also should be understood as applying to the control body and the cartridge as individual and separate components.

In another aspect, the invention can be directed to kits that provide a variety of components as described herein. For example, a kit can comprise a control body with one or more cartridges. A kit further can comprise a control body with one or more charging components. A kit further can comprise a control body with one or more batteries. A kit further may comprise a control body
5 with one or more cartridges and one or more charging components and/or one or more batteries. In further embodiments, a kit may comprise a plurality of cartridges. A kit further may comprise a plurality of cartridges and one or more batteries and/or one or more charging components. The inventive kits further can include a case (or other packaging, carrying, or storage component) that accommodates one or more of the further kit components. The case can be a reusable hard or soft
10 container. Further, the case can be simply a box or other packaging structure.

Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed herein and that modifications
15 and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS:

1. A smoking article, comprising:
a power source;
a control component adapted to control power delivery from the power source; and
a heating connection comprising a heating element and a fusible link;
5 wherein the power source, the control component, and the heating connection define a
closed electrical circuit.
2. A smoking article according to Claim 1, wherein a control body houses the power
source and the control component, wherein a cartridge body houses the heating connection, and
10 wherein the cartridge body is configured to removably engage the control body and thus establish
the closed electrical circuit.
3. A smoking article according to Claim 1 or Claim 2, wherein the heating element is a
resistance heating element.
15
4. A smoking article according to any one of Claims 1 to 3, wherein the fusible link is
an electrical fusible link or a mechanical fusible link.
5. A smoking article according to any one of Claims 1 to 4, wherein the fusible link is
20 adapted to fail under electrical conditions sufficient to initiate heating of the heating element.
6. A smoking article according to any one of Claims 1 to 5, wherein the fusible link
and the heating element are electrically aligned in parallel arrangement.
- 25 7. A smoking article according to any one of Claims 1 to 6, wherein the control
component is configured to selectively actuate a first electrical current flow of a first set of
conditions from the power source to the heating connection, said first electrical current flow being
insufficient to initiate heating by the heating element.
- 30 8. A smoking article according to Claim 7, wherein the first set of conditions
comprises a voltage that is substantially the same as a voltage that defines a working voltage for the
heating element and a current flow duration of about 45 milliseconds or less or about 5
milliseconds to about 25 milliseconds.

9. A smoking article according to Claim 8, wherein the working voltage is about 2 volts to about 6 volts.

5 10. A smoking article according to any one of Claims 1 to 9, wherein the electrical circuit further comprises a current sense resistor.

11. A smoking article according to Claim 10, wherein the current sense resistor is adapted to measure a value that is indicative of the fusible link status, and wherein the control
10 component is adapted to initiate a logic sequence based upon a value received from the current sense resistor.

12. A smoking article according to Claim 11, wherein, based upon the logic sequence, the control component is configured to either allow normal use of the cartridge engaging the control
15 body or temporarily disable the control body until engaged with a different cartridge.

13. A smoking article according to any one of Claims 7 to 12, wherein the control component is configured to selectively actuate a second electrical current flow of a second set of conditions from the power source to the heating connection, said second electrical current flow
20 being sufficient to initiate heating by the heating element.

14. A smoking article according to Claim 13, wherein the second electrical current flow is applied for a time duration that exceeds a current flow time at which the fusible link is adapted to fail.
25

15. A smoking article according to any one of Claims 1 to 14, wherein the cartridge body further comprises a consumable arrangement in communication with the heating element.

16. A smoking article according to Claim 15, wherein the consumable arrangement comprises a substrate and an aerosol precursor composition, and wherein the aerosol precursor
30 composition is one of coated on, adsorbed by, and absorbed in at least a portion of the substrate.

17. A method of detecting a status of a cartridge in a smoking article, comprising:
providing a control body comprising a control component and a power source;

providing a cartridge body comprising a heating connection comprising a heating element and a fusible link; and

removably engaging the cartridge body with the control body so as to establish a closed electrical circuit comprising the heating connection, the power source, and the control component, and so as to cause the control component to initiate a first electrical current flow of a first set of conditions from the power source to the heating connection, wherein the control component identifies a cartridge status based upon a characteristic of the first electrical current flowing through the electrical circuit.

10 18. A method according to Claim 17, wherein the closed electrical circuit further comprises a current sense resistor positioned in one of the control body and the cartridge, and wherein the current sense resistor measures the characteristic of the first electrical current and relays the measurement to the control component.

15 19. A method according to Claim 17 or claim 18, wherein a first value for the characteristic is processed by the control component as being indicative of an intact fusible link and an unused cartridge.

20 20. A method according to Claim 17 or claim 18, wherein a second value for the characteristic is processed by the control component as being indicative of a failed fusible link and a used cartridge.

25 21. A method according to Claim 17, wherein the conditions of the first electrical current flow are insufficient to initiate heating of the heating element.

22. A method according to any one of Claims 17 to 21, wherein the cartridge body comprises a consumable arrangement in communication with the heating element.

30 23. A method according to Claim 22, wherein the consumable arrangement comprises a substrate and an aerosol precursor composition, and wherein the aerosol precursor composition is one of coated on, adsorbed by, and absorbed in at least a portion of the substrate.

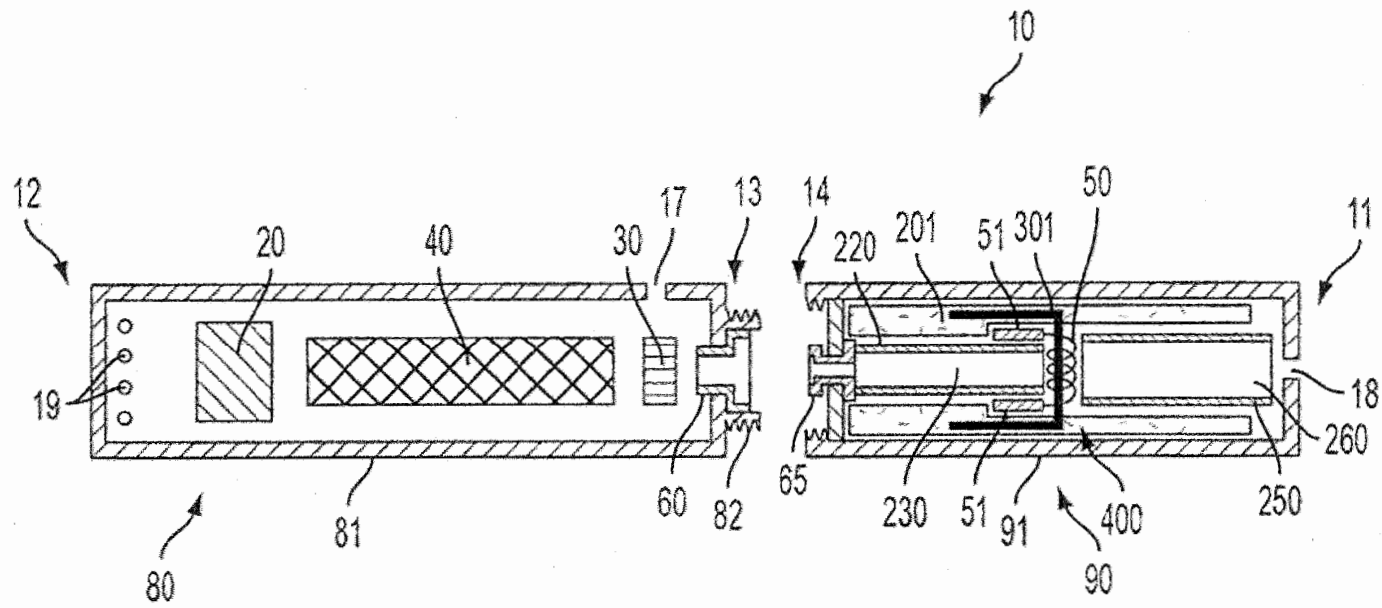
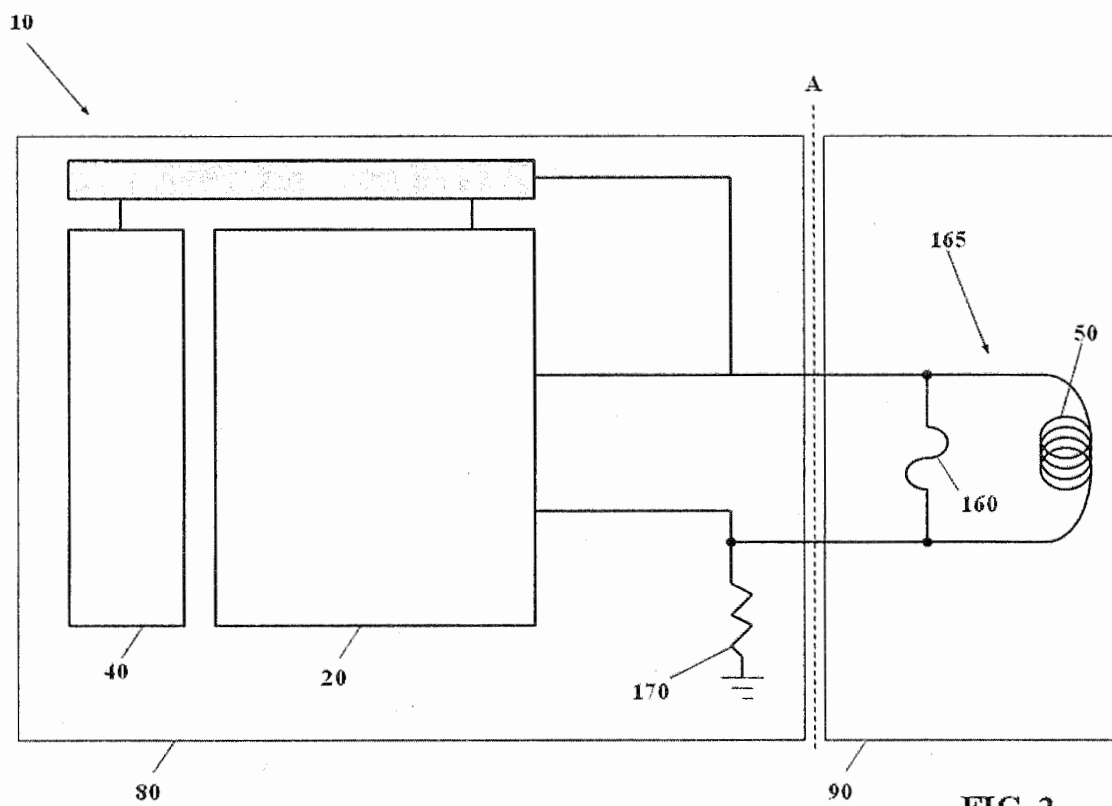


Fig. 1

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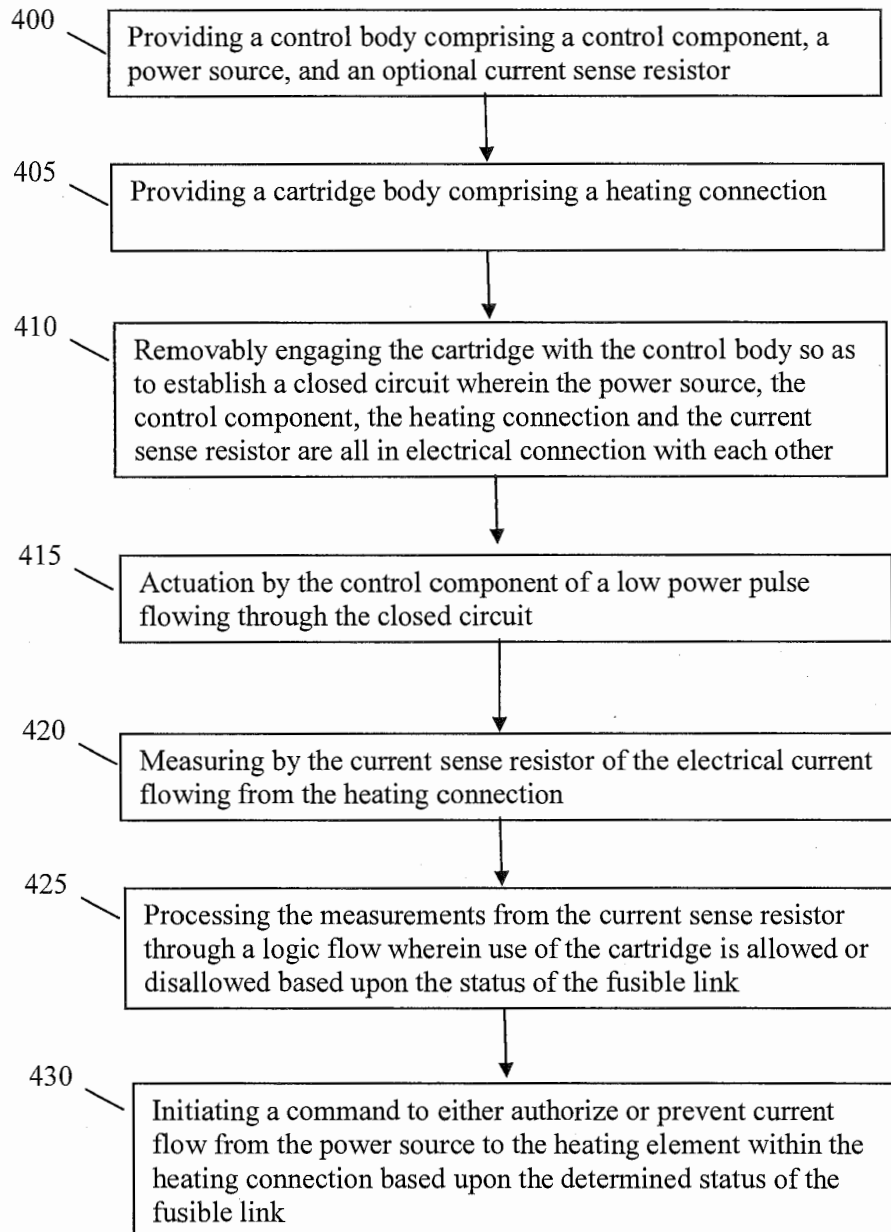


FIG. 3

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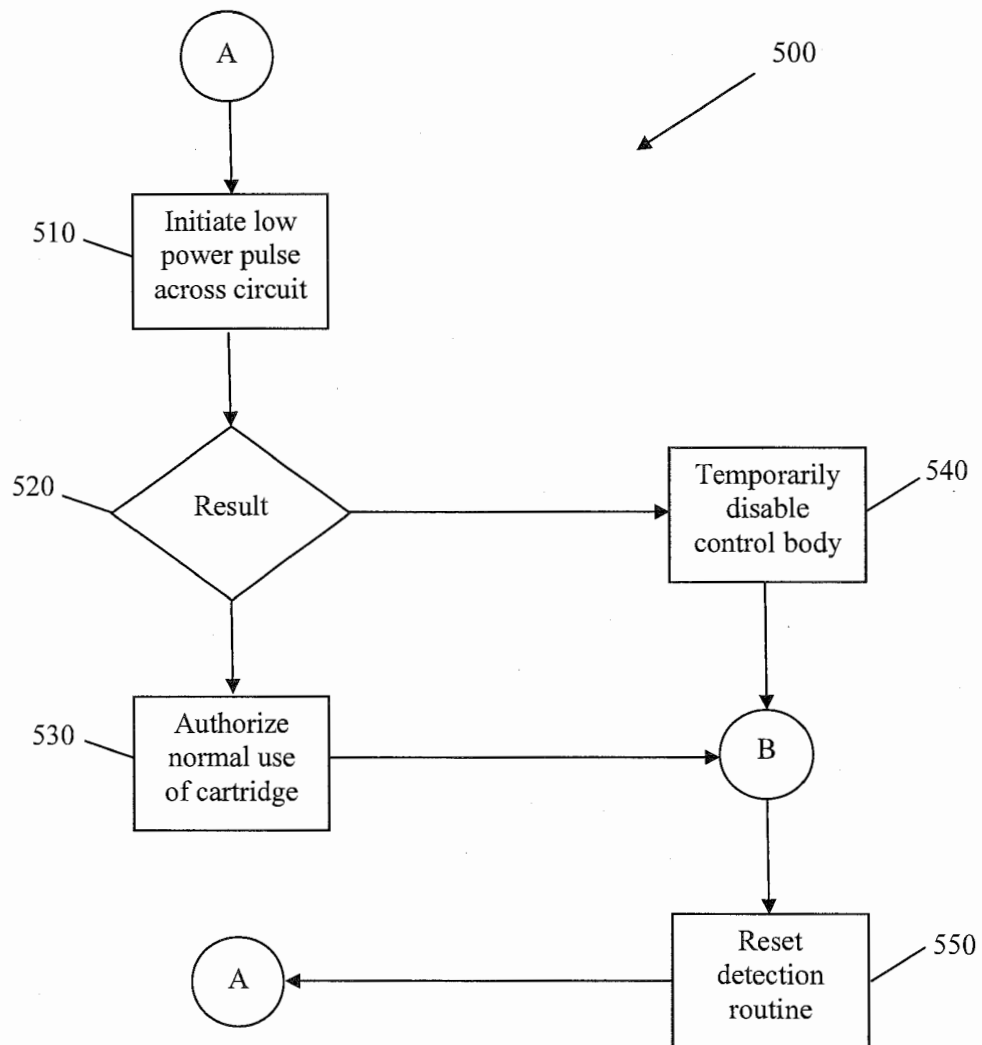


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/020770

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)

EP0-Internal, WPI Data

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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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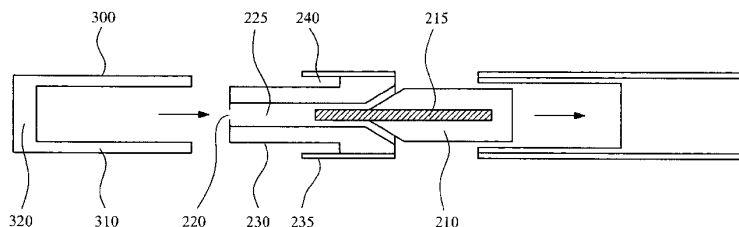


FIG. 2

(57) Abstract: There is provided an aerosol-generating device comprising: a housing containing or configured to receive an aerosol-forming substrate; an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet; wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining a compliant mouthpiece cover to the housing. In use, the mouthpiece cover is placed into a user's mouth in order to directly inhale an aerosol generated by the aerosol-generating device. There is also provided a removable mouthpiece cover for an electrically operated smoking device, comprising a compliant tubular portion defining a central bore and a filter portion covering the bore of the filter portion.

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AN AEROSOL-GENERATING SYSTEM WITH A REPLACABLE MOUTHPIECE COVER

The present invention relates to aerosol generating systems. In particular, the present invention relates to aerosol generating systems, such as electrically operating smoking systems, to which a replaceable mouthpiece cover can be easily fitted and removed.

Electrically heated smoking systems are known in the art. WO-A-2009/132793 discloses an example of an electrically heated smoking system. A liquid is stored in a liquid storage portion, and a capillary wick has a first end which extends into the liquid storage portion for contact with the liquid therein, and a second end which extends out of the liquid storage portion. A heating element heats the second end of the capillary wick. The heating element is in the form of a spirally wound electric heating element in electrical connection with a power supply, and surrounding the second end of the capillary wick. In use, the heating element may be activated by the user to switch on the power supply. Suction on a mouthpiece by the user causes air to be drawn into the electrically heated smoking system over the capillary wick and heating element and subsequently into the mouth of the user.

The substrate used with an aerosol generating device can be provided in a cartridge that can be refilled or replaced when the supply of aerosol-forming substrate has been depleted. Supplying the aerosol-forming substrate in a cartridge has a number of advantages. But there is an opportunity for improvement in the design of such devices.

It is an objective of the present invention to provide an aerosol-generating device and system that is hygienic, inexpensive and convenient to use.

In one aspect, there is provided an aerosol-generating device comprising:

a housing containing or configured to receive an aerosol-forming substrate;

an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;

wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining a compliant mouthpiece cover to the housing.

In use, the mouthpiece cover is placed into a user's mouth in order to directly inhale an aerosol generated by the aerosol-generating device. The retention of a replaceable compliant mouthpiece cover between two concentric walls has been found to be an effective solution to the problem of mouthpiece covers becoming disengaged from a housing during use, while allowing for easy mounting and removal of mouthpiece covers.

The aerosol-generating device may comprise a main body and a cartridge, wherein the cartridge is connectable to the main body and wherein the cartridge contains an aerosol-forming substrate. The first or second wall may be part of the cartridge or may be part of the main body. For example, the first and second walls may be part of the cartridge. Alternatively, the first wall may be part of the cartridge and the second wall may be part of the main body. Alternatively, the first and second walls may be part of the main body. It is also possible that one portion of one of the first and second walls is part of the cartridge and another portion of the one of the first and second walls is part of the main body.

The device may include a gripping mechanism which is operable to grip a mouthpiece cover received in the annular recess to ensure it is retained in the recess during use of the device. For example, a resilient o-ring or helical spring may be received in a groove in the second wall, the o-ring or spring being configured to grip a mouthpiece cover received in the recess. A slidable collar may be provided around the o-ring or spring wherein the slidable collar is movable between a first position in which the collar does not compress the resilient o-ring or spring and a second position in which the collar does compress the resilient o-ring or spring.

The housing may alternatively or additionally include spikes or claws in a closed end of the annular recess configured to pierce or grip a compliant mouthpiece cover received in the recess. The first wall may be of different cross sectional shape to the second wall to provide areas of higher compression on the mouthpiece cover. Alternatively, or in addition, the first or second walls may comprise one or more ridges or bumps extending into the recess to provide areas of higher compression on the mouthpiece cover when it is received in the recess.

The first or second wall, or both the first and second wall, may be formed of a plurality of separate sections and may be continuous or discontinuous.

The term "annular" is intended to mean not just a circular ring shape but a closed loop of any cross-section. However, the first and second walls may be circular so as to define a circularly annular recess.

The term "compliant mouthpiece cover" as used herein means a mouthpiece cover that is pliable and can be readily deformed without breaking or cracking. In particular the compliant mouthpiece cover is preferably readily compressed but resilient.

The housing may comprise any suitable material or combination of materials. Examples of suitable materials include metals, alloys, plastics or composite materials containing one or more of those materials, or thermoplastics that are suitable for food or pharmaceutical applications, for example polypropylene, polyetheretherketone (PEEK) and polyethylene. Preferably, the material is light and non-brittle.

Preferably, the device housing may be elongate. Preferably, the aerosol generating device

is portable. The aerosol generating device may be a smoking device and may have a size comparable to a conventional cigar or cigarette. The smoking device may have a total length between approximately 30 mm and approximately 150 mm. The smoking device may have an external diameter between approximately 5 mm and approximately 30 mm.

In another aspect, there is provided a consumable cartridge for an aerosol-generating system, comprising:

- a housing containing an aerosol-forming substrate;

- an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;

- wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining a compliant mouthpiece cover to the housing.

In yet another aspect, there is provided a kit for an aerosol-generating system, comprising:

- an aerosol-generating device and a compliant mouthpiece cover, the device comprising:

- a housing containing or configured to receive an aerosol-forming substrate;

- an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;

- wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining the compliant mouthpiece cover to the housing;

- wherein the compliant mouthpiece cover comprises a tubular section configured to fit in the annular recess and is configured to allow aerosol delivered through the outlet to pass through the mouthpiece cover and into the mouth of a user in use.

The mouthpiece cover may be configured to slide into the annular recess so that the tubular section is retained in the annular recess. The annular recess may be dimensioned so that the tubular portion of the mouthpiece cover is radially compressed between the first wall and the second wall when the mouthpiece cover is engaged with the recess.

The mouthpiece cover or the housing, or both the mouthpiece cover and the housing may be shaped to aid insertion of the mouthpiece cover into the annular recess. For example, the second wall may be flared so that the annular recess has a larger cross-section at its open end. Similarly, the mouthpiece cover may be tapered at an insertion end, where the insertion end is the end of the mouthpiece cover that is first received by the annular recess during engagement of the mouthpiece cover with the housing.

The mouthpiece cover may comprise a filter portion connected to the tubular portion, the filter portion covering a bore of the tubular section. The filter portion may have low filtration efficiency. The filter portion may be used to provide a desired resistance to draw for the aerosol-generating system.

The mouthpiece cover can be used for a single user session or smoking experience and then discarded. A new mouthpiece cover can be provided when the system is to be used again. This reduces the risk of build up of undesirable residues and pathogens on the mouthpiece cover portion and reduces the cleaning burden on the user. Alternatively, the mouthpiece cover may be cleaned after each use and then reused.

The removable mouthpiece cover may mimic the filter of a conventional cigarette in look and feel. For example, the removable mouthpiece cover may be formed from cellulose acetate, rubber, or plastic, such as polyethylene or polypropylene or a mixture of both, and may be covered with a paper layer.

The aerosol-generating device may be a smoking device. The device may contain sufficient aerosol-forming substrate for a plurality of smoking sessions. In that case the kit may comprise a plurality of mouthpiece covers. In particular, the device may contain sufficient aerosol-forming substrate for a predetermined number of average smoking sessions and the kit may contain that predetermined number of mouthpiece covers so that a different mouthpiece cover may be used for each smoking session.

The smoking device may comprise a main body and a cartridge, wherein the cartridge is connectable to the main body and wherein the cartridge contains an aerosol-forming substrate.

In yet another aspect there is provided a kit for an aerosol-generating system, comprising:
a consumable cartridge for an aerosol-generating system, the cartridge contain an aerosol-forming substrate; and
a plurality of compliant mouthpiece covers

The aerosol-generating system may be a smoking system. The cartridge may contain sufficient aerosol-forming substrate for a predetermined plurality of average smoking sessions and the kit may contain that predetermined number of mouthpiece covers so that a different mouthpiece cover may be used for each smoking session.

The consumable cartridge may comprise:
a housing containing the aerosol-forming substrate; and
an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;

wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and

second walls, the annular recess being suitable for retaining a compliant mouthpiece cover to the housing.

The compliant mouthpiece covers may comprise a tubular section configured to fit in the annular recess and being configured to allow aerosol delivered through the outlet to pass through the mouthpiece cover and into the mouth of a user in use.

For all aspects of the invention, the aerosol forming substrate may be a liquid aerosol forming substrate. The aerosol-forming substrate may contain nicotine. The aerosol-forming substrate may be adsorbed, coated, impregnated or otherwise loaded onto a carrier or support. The aerosol-forming substrate may be a solid substrate.

In some embodiments, the device or cartridge comprises a capillary wick in communication with the supply or aerosol-forming substrate. It is also possible for a capillary wick to be preloaded with liquid, forming the supply of aerosol-forming substrate.

Preferably, the capillary wick is arranged to be in contact with liquid in a liquid storage portion of the device or cartridge. In that case, in use, liquid is transferred from the liquid storage portion towards the at least one electric heating element by capillary action in the capillary wick. In one embodiment, the capillary wick has a first end and a second end, the first end extending into the liquid storage portion for contact with liquid therein and at least one electric heating element is arranged to heat liquid in the second end. When the heating element is activated, the liquid at the second end of the capillary wick is vaporized by the heating element to form the supersaturated vapour. The supersaturated vapour is mixed with and carried in the airflow. During the flow, the vapour condenses to form the aerosol and the aerosol is carried towards the mouth of a user through the outlet and mouthpiece cover. The heating element in combination with a capillary wick may provide a fast response, because that arrangement may provide a high surface area of liquid to the heating element. Control of the heating element according to the invention may therefore depend on the structure of the capillary wick arrangement.

A liquid substrate may be absorbed into a porous carrier material, which may be made from any suitable absorbent plug or body. For example, any suitable absorbent plug or body may be a foamed metal or plastics material, polypropylene, terylene, nylon fibres or ceramic. The liquid substrate may be retained in the porous carrier material prior to use of the electrically heated aerosol generating device or alternatively, the liquid substrate material may be released into the porous carrier material during, or immediately prior to use. For example, the liquid substrate may be provided in a capsule. The shell of the capsule preferably melts upon heating and releases the liquid substrate into the porous carrier material. The capsule may optionally contain a solid in combination with the liquid.

If the aerosol-forming substrate is a liquid substrate, the liquid must have suitable physical

properties. These include, for example, a boiling point, vapour pressure, and surface tension characteristics to make them suitable for use in the aerosol generating device. Control of the at least one electric heating element may depend upon the physical properties of the liquid substrate. The liquid may comprise a tobacco-derived material comprising volatile tobacco flavour compounds which are released from the liquid upon heating. Alternatively, or in addition, the liquid may comprise a non-tobacco material. The liquid may include water, solvents, ethanol, plant extracts and natural or artificial flavours. Preferably, the liquid further comprises an aerosol former. Examples of suitable aerosol formers are glycerine and propylene glycol. The liquid preferably comprises a mix of aerosol formers e.g. glycerine, propylene glycol; a water fraction, nicotine and flavours.

An advantage of providing a liquid storage portion is that a high level of hygiene can be maintained. Using a capillary wick extending between the liquid and the electric heating element, allows the structure of the device to be relatively simple. The liquid has physical properties, including viscosity and surface tension, which allow the liquid to be transported through the capillary wick by capillary action.

The capillary body may comprise any suitable material or combination of materials which is able to convey the liquid aerosol-forming substrate towards the vaporizer. The capillary body preferably comprises a porous material, but this need not be the case. The capillary body may have the form of a wick. The capillary wick may have a fibrous or spongy structure. The capillary wick preferably comprises a bundle of capillaries. For example, the capillary wick may comprise a plurality of fibres or threads, or other fine bore tubes. The fibres or threads may be generally aligned in the longitudinal direction of the aerosol generating device. Alternatively, the capillary wick may comprise sponge-like or foam-like material formed into a rod shape. The rod shape may extend along the longitudinal direction of the aerosol-generating device. The structure of the wick forms a plurality of small bores or tubes, through which the liquid can be transported to the electric heating element, by capillary action. The capillary wick may comprise any suitable material or combination of materials. Examples of suitable materials are ceramic-based or graphite-based materials in the form of fibres or sintered powders. The capillary wick may have any suitable capillarity and porosity so as to be used with different liquid physical properties such as density, viscosity, surface tension and vapour pressure. The capillary properties of the wick, combined with the properties of the liquid, ensure that the wick is always wet in the heating area.

Preferably, the cartridge includes an electrically operated aerosol generating element and electrical contacts for connection of the aerosol generating element to a power supply contained in the device. The electrically operated aerosol generating element is preferably an electric heater.

The electric heater may comprise a single heating element. Alternatively, the electric heater

may comprise more than one heating element, for example two, or three, or four, or five, or six or more heating elements. The heating element or heating elements may be arranged appropriately so as to most effectively heat the aerosol-forming substrate.

In a preferred embodiment, the at least one heating element is a coil of electrically resistive wire. The pitch of the coil is preferably between 0.5 and 1.5 mm, and most preferably approximately 1.5mm. The pitch of the coil means the spacing between adjacent turns of the coil. The coil may advantageously comprise fewer than six turns, and preferably has fewer than five turns.

The at least one electric heating element preferably comprises an electrically resistive material. Suitable electrically resistive materials include but are not limited to: semiconductors such as doped ceramics, electrically "conductive" ceramics (such as, for example, molybdenum disilicide), carbon, graphite, metals, metal alloys and composite materials made of a ceramic material and a metallic material. Such composite materials may comprise doped or undoped ceramics. Examples of suitable doped ceramics include doped silicon carbides. Examples of suitable metals include titanium, zirconium, tantalum and metals from the platinum group. Examples of suitable metal alloys include stainless steel, Constantan, nickel-, cobalt-, chromium-, aluminium- titanium- zirconium-, hafnium-, niobium-, molybdenum-, tantalum-, tungsten-, tin-, gallium-, manganese- and iron-containing alloys, and super-alloys based on nickel, iron, cobalt, stainless steel, Timetal®, iron-aluminium based alloys and iron-manganese-aluminium based alloys. Timetal® is a registered trade mark of Titanium Metals Corporation, 1999 Broadway Suite 4300, Denver Colorado. In composite materials, the electrically resistive material may optionally be embedded in, encapsulated or coated with an insulating material or vice-versa, depending on the kinetics of energy transfer and the external physicochemical properties required. The heating element may comprise a metallic etched foil insulated between two layers of an inert material. In that case, the inert material may comprise Kapton®, all-polyimide or mica foil. Kapton® is a registered trade mark of E.I. du Pont de Nemours and Company, 1007 Market Street, Wilmington, Delaware 19898, United States of America.

In a preferred embodiment, in which the at least one heating element is a coil of electrically resistive wire, and the electrically resistive wire advantageously has a diameter of between 0.10 and 0.15mm, and preferably of approximately 0.125mm. The electrically resistive wire is preferably formed of 904 or 301 stainless steel.

Alternatively, the at least one electric heating element may comprise an infra-red heating element, a photonic source, or an inductive heating element.

The heating element may take any suitable form. For example, the heating element may take the form of a heating blade. Alternatively, the heating element may take the form of a casing or substrate having different electro-conductive portions, or an electrically resistive metallic tube. If

the aerosol-forming substrate is a liquid provided within a container, the container may incorporate a disposable heating element. Alternatively, one or more heating needles or rods that run through the centre of the aerosol-forming substrate may also be suitable. Alternatively, the heating element may be a disk (end) heating element or a combination of a disk heating element with heating needles or rods. Alternatively, the heating element may comprise a flexible sheet of material arranged to surround or partially surround the aerosol-forming substrate. Other alternatives include a heating wire or filament, for example a Nickel Chromium (Ni-Cr), platinum, tungsten or alloy wire, or a heating plate. Optionally, the heating element may be deposited in or on a rigid carrier material.

The heating element may heat the aerosol-forming substrate by means of conduction. The heating element may be at least partially in contact with the substrate, or the carrier on which the substrate is deposited. Alternatively, the heat from the heating element may be conducted to the substrate by means of a heat conductive element.

Alternatively, the heating element may transfer heat to the incoming ambient air that is drawn through the electrically heated aerosol generating device during use, which in turn heats the aerosol-forming substrate by convection. The ambient air may be heated before passing through the aerosol-forming substrate. Alternatively, if the aerosol-forming substrate is a liquid substrate, the ambient air may be first drawn through the substrate and then heated.

Preferably the device includes electric circuitry for controlling the operation of the device. The electric circuitry may comprise a microcontroller. The microcontroller may include a proportional–integral–derivative (PID) regulator for controlling the power supplied to a heating element. The electric circuitry may be included in the cartridge and may be the functional element in the insertion portion of the cartridge.

The device may include a flow sensor for detecting a flow rate of gas through the device. The sensor may be any sensor which can detect airflow, such as would be indicative of a user inhaling. The sensor may be an electro-mechanical device. Alternatively, the sensor may be any of: a mechanical device, an optical device, an opto-mechanical device, a micro electro mechanical systems (MEMS) based sensor and an acoustic sensor. The sensor can be a thermal conductive flow sensor, a pressure sensor, an anemometer and should be able to not only detect an airflow but should be able to measure the airflow. So, the sensor should be able to deliver an analogue electrical signal or digital information that is representative of the amplitude of the air flow. The flow sensor may be positioned in the main body of the device or in the cartridge.

The aerosol generating device may comprise an aerosol-forming chamber in which aerosol forms from a super saturated vapour, which aerosol is then carried into the mouth of a user. An air inlet and the chamber are preferably arranged so as to define an airflow route from the air inlet to

the outlet via the aerosol-forming chamber, so as to convey the aerosol to the air outlet and into the mouth of a user. In a system comprising a cartridge containing the aerosol-forming substrate, the aerosol-forming chamber is preferably in the cartridge.

In a further aspect, there is provided a removable mouthpiece cover for an electrically operated smoking device, comprising a compliant tubular portion defining a central bore and a filter portion covering the bore of the filter portion.

The tubular portion may be formed of cellulose acetate. The filter portion may also be formed from cellulose acetate. The tubular portion and the filter portion may be formed from biodegradable materials. The mouthpiece cover may mimic the filter of a conventional cigarette in look and feel, for example in smoothness and pliability.

It should be clear that features described in relation to one aspect of the invention may be applicable to another aspect of the invention. In particular, it should be clear that features described in relation to one aspect may equally be applied to another aspect and that many of the features described in relation to the cartridge of one aspect may equally be included in the main body of the device of the other aspect.

The invention will be further described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a schematic cross section of an aerosol-generating system in accordance with an embodiment of the invention;

Figure 2 shows the system of Figure 1 in a disassembled state;

Figure 3 is a perspective view of a system of the type illustrated in Figure 1 with the mouthpiece cover removed; and

Figure 4 is a perspective view of the system of Figure 3 with the mouthpiece cover inserted.

Figure 1 is a schematic cross section of an aerosol generating system in accordance with an embodiment of the invention. The system comprises of a main body 100, a cartridge 200 and mouthpiece cover 300.

Figure 2 shows the system of figure 1 in a disassembled state with the three components of the main body 100, cartridge 200 and mouthpiece cover 300 shown separate from one another.

The system shown in figures 1 and 2 is of the type described in WO2009/132793.

The main body 100 of the system has an electrical power supply, in the form of a battery and electric circuitry in the form of hardware. The cartridge 200, has an aerosol forming substrate within a liquid storage portion 210 and a heater (not shown) that, in use, vaporises the aerosol forming substrate to form an aerosol. A capillary wick 215 extends from within the liquid storage portion 210, to a position within an aerosol forming chamber 225. The heater is in the form of a resistive heating element, such as a coil heater, in contact with the capillary wick. Power to the

electric heater is supplied from the battery within the main body 100. Electrical contact is made between the cartridge 200 and the main body 100 when they are in an assembled condition, as shown in Figure 1.

An air inlet or inlets (not shown), which may be formed in either the main body 100 or the cartridge 200, or between the main and the cartridge, allow air to enter the device and from there pass through the aerosol forming chamber 225 to an outlet 220. In use, the air is drawn through the air inlet to the air outlet by the action of a user sucking or inhaling on the mouthpiece cover 300. Ambient air enters the air inlet or air inlets and passes the heating element and capillary wick where it entrains vaporised aerosol forming substrate. The vaporised aerosol forming substrate then cools to form an aerosol before exiting through the outlet 220.

A puff detection system (not shown) provided in the main body or in the cartridge, senses the user taking a puff on the mouthpiece cover. The battery then supplies energy to the heating element to heat the end of the wick surrounded by the heating element. The liquid aerosol-forming substrate in that end of the wick is vaporised by the heating element to create a super saturated vapour. At the same time, the liquid being vaporised is replaced by further liquid being drawn up through the wick by capillary action. The super saturated vapour that is created is mixed with and carried in the air flow. As previously described, the vapour condenses in the aerosol forming chamber to form an inhalable aerosol which is carried through the outlet 220 and into the mouth of the user.

In this embodiment, the mouthpiece cover 300 engages with the cartridge 200. The mouthpiece cover 300 is formed of cellulose acetate, covered with an external paper layer. The mouthpiece cover comprises a tubular portion 310 and a filter portion 320. The tubular portion of the mouthpiece cover slides over a first wall 230 of the cartridge, but inside a second wall 235 of the cartridge. First and second walls of the cartridge define an annular recess 240 in which a portion of the tubular portion of the mouthpiece cover is retained, as shown in Figure 1.

In this embodiment, the mouthpiece cover, cartridge and main body are all of circular cross section, as can be seen more clearly in Figures 3 and 4. Figure 3 shows a device of the type shown in Figure 1 and Figure 2 with the mouthpiece cover 300 separate from the main body 100 and the cartridge 200. Figure 4 shows the system with the mouthpiece cover 300 engaged by the recess 240 in the cartridge 200. The system in the configuration of Figure 4 is ready for use.

In order to ensure that the mouthpiece cover is retained in the recess 240 during use, the recess 240 is dimensioned to compress the tubular portion 310 of the mouthpiece cover 300. The tubular portion of the mouthpiece cover is formed of a material that is readily compressed but is resilient. The open end of the recess 240 may be flared in order to allow for easy insertion of the mouthpiece cover 300 into the recess 240. An insertion end of the mouthpiece cover 300 may

also be tapered in order to ensure easy insertion of the mouthpiece cover in to the recess. The first wall 230 may also be tapered to allow for easy insertion of a mouthpiece cover but increasing compression of the mouthpiece filter as it is fully inserted into the recess.

A plurality of mouthpiece covers 300 may be provided in a single package, possibly with a cartridge 200. The mouthpiece covers may be packaged so that when the package is opened the open ends of the tubular portions 310 face outwards from the package. A user would then simply need to introduce the device (i.e. the cartridge 200 assembled to the main body) into a selected mouthpiece cover, thereby inserting the mouthpiece cover into the recess without having to remove the mouthpiece cover from the package and insert in manually. After a smoking session, the used mouthpiece cover can be pulled out of the recess and disposed of or cleaned.

The mouthpiece covers may provide very little filtration of the aerosol if desired. Alternatively, the filter portion 320 may be made thicker or formed differently to provide significant filtration of the aerosol as desired.

The first and second walls of this embodiment are formed from polypropylene and are injection moulded. However, any suitable material and manufacturing process may be used. In order to enhance the retention of the mouthpiece cover 300 in the recess 240 additional elements may be provided. For example, a plurality of moulded spikes or barbs may be provided within the recess that each act to grip mouthpiece covers. Alternatively, one or more ridges or bumps may be provided on the first or second walls. The ridges or bumps may be formed from a compliant material.

A tightening mechanism may be provided to allow for manually actuated gripping of the mouthpiece cover following insertion into the recess. For example, a resilient o-ring or helical spring may be received in a groove in the second wall, the o-ring or spring being configured to grip a mouthpiece cover received in the recess. A slidable collar may be provided around the o-ring or spring wherein the slidable collar is movable between a first position in which the collar does not compress the resilient o-ring or spring and a second position in which the collar does compress the resilient o-ring or spring.

A mouthpiece cover and aerosol-generating device in accordance with the invention has several advantages, in particular for an electrically operated smoking system. A new mouthpiece may be used for each smoking session. This improves hygiene and allows a smoking system to be shared between users more readily. The mouthpiece cover may be made to have the same dimensions, look and feel as a conventional cigarette, which is preferred by many users. The mouthpiece covers can be manufactured using the same materials, processes and technology as conventional cigarette filters, which are already produced inexpensively and in high volumes. The use of the same materials as conventional filters also has the advantage that these filters have

been exhaustively tested for the conventional cigarette market and are known to be suitable for use as a mouthpiece cover.

It should be clear that many variations are possible to the embodiment described with reference to Figure 1 to 4. For example, the relative lengths of the first and second walls may be different, and the length of the mouthpiece cover may be altered to suit user preference or aesthetics.

Furthermore, the mouthpiece cover and its retention in an annular recess may be used with different constructions on aerosol-generating system. For example, an aerosol-generating device may be configured so that the cartridge is held entirely within a main housing. In that case, the second wall, and possibly also the first wall would be part of the main housing. Alternatively, the cartridge may comprise the first wall and the main housing comprises the second wall. The cartridge may even comprise only a portion of the first or second wall, or a portion of both the first and second wall.

The aerosol-generating device may not include a separate cartridge and main housing. Instead the main housing may contain the aerosol-forming substrate. In that case, the device may be refillable with substrate or may be disposed of when the substrate has been consumed.

The exemplary embodiments described above illustrate but are not limiting. In view of the above discussed exemplary embodiments, other embodiments consistent with the above exemplary embodiments will now be apparent to one of ordinary skill in the art.

CLAIMS

1. An aerosol-generating device comprising:
a housing containing or configured to receive an aerosol-forming substrate;
an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;
wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining a compliant mouthpiece cover to the housing, the compliant mouthpiece being readily compressed but resilient.
2. An aerosol-generating device according to claim 1, comprising a main body and a cartridge, wherein the cartridge is connectable to the main body and wherein the cartridge contains an aerosol-forming substrate and wherein the first and second walls are part of the cartridge.
3. An aerosol-generating device according to claim 1, comprising a main body and a cartridge, wherein the cartridge is connectable to the main body and wherein the cartridge contains an aerosol-forming substrate and wherein the first wall is part of the cartridge and the second wall is part of the main body.
4. An aerosol-generating device according to any preceding claim, further comprising a gripping mechanism which is operable to grip a mouthpiece cover received in the annular recess to during use of the device.
5. An aerosol-generating device according to any preceding claim, wherein the aerosol-generating device is a smoking device and has a size comparable to a conventional cigar or cigarette.
6. A cartridge for an aerosol-generating system, comprising:
a housing containing an aerosol-forming substrate;
an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;
wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and

second walls, the annular recess being suitable for retaining a compliant mouthpiece cover, which is readily compressed but resilient, to the housing.

7. A kit for an aerosol-generating system, comprising:
an aerosol-generating device and a compliant, readily compressed but resilient, mouthpiece cover, the device comprising:

a housing containing or configured to receive an aerosol-forming substrate;

an outlet formed in the housing, wherein in use aerosol generated from the aerosol-forming substrate is delivered through the outlet;

wherein the housing comprises a first wall surrounding the outlet and a second wall surrounding the first wall such that an open-ended annular recess is defined between the first and second walls, the annular recess being suitable for retaining the compliant mouthpiece cover to the housing;

wherein the compliant mouthpiece cover comprises a tubular section configured to fit in the annular recess and being configured to allow aerosol delivered through the outlet to pass through the mouthpiece cover and into the mouth of a user in use.

8. A kit according to claim 7, wherein the tubular section of the mouthpiece cover is configured to slide into the annular recess.

9. A kit according to claim 7 or 8, wherein the annular recess is dimensioned so that the tubular portion of the mouthpiece cover is radially compressed between the first wall and the second wall when the mouthpiece cover is engaged with the recess.

10. A kit according to any one of claims 7, 8 or 9, wherein the mouthpiece cover comprises a filter portion connected to the tubular portion, the filter portion covering a bore of the tubular section.

11. A kit according to any one of claims 7 to 10, wherein the removable mouthpiece cover is formed from cellulose acetate and is covered with a paper layer.

12. A kit according to any one of claims 7 to 11, wherein the aerosol-generating device is a smoking device and contains sufficient aerosol-forming substrate for a plurality of smoking sessions, and wherein the kit comprises a plurality of mouthpiece covers.

13. A kit for an aerosol-generating system, comprising

a consumable cartridge for an aerosol-generating system, the cartridge contain an aerosol-forming substrate; and

a plurality of compliant, readily compressed but resilient, mouthpiece covers.

14. A kit according to claim 13, wherein the aerosol-generating system is a smoking system

15. A removable mouthpiece cover for an electrically operated smoking device, comprising a compliant, readily compressed but resilient, tubular portion defining a central bore and a filter portion covering the bore of the filter portion.

-1/2-

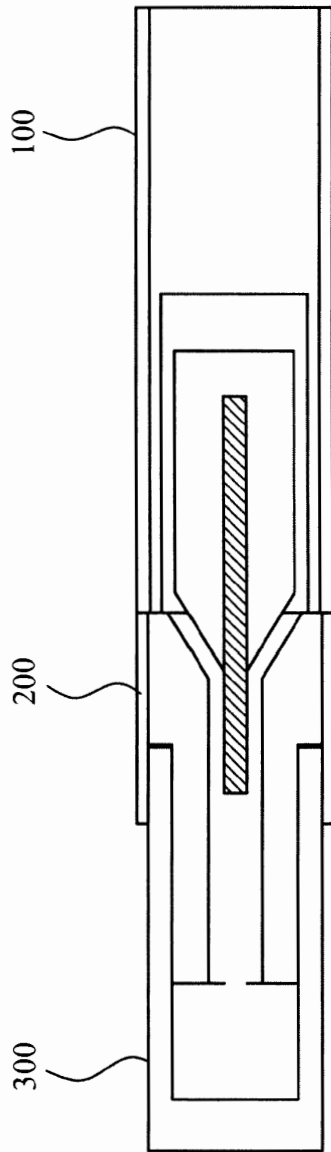


FIG. 1

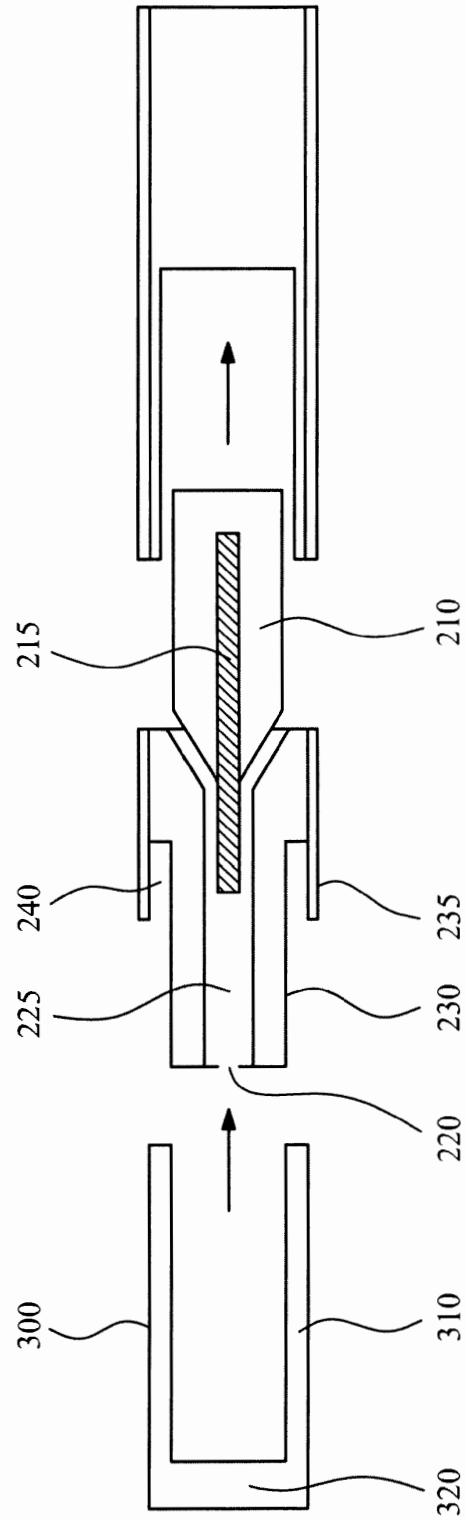


FIG. 2

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FIG. 3

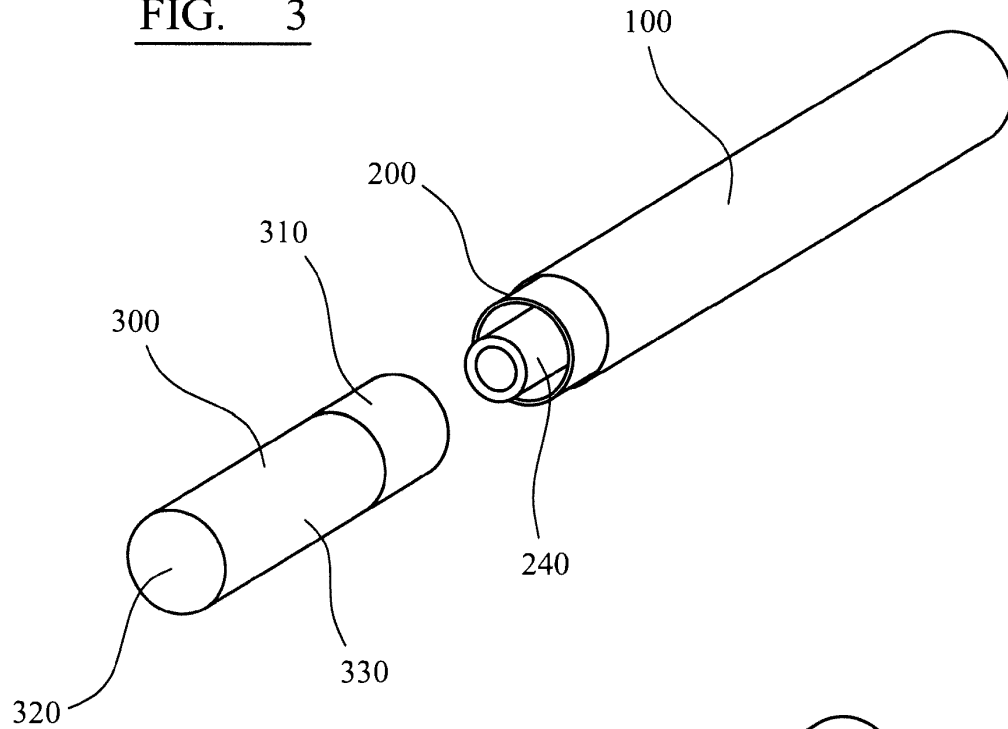
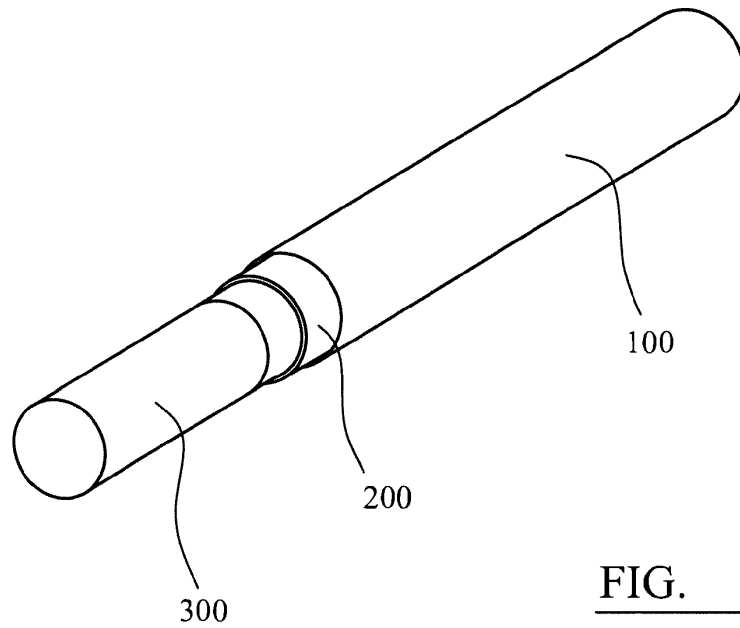


FIG. 4

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[Continued on next page]

(54) Title: HEATING ELEMENTS FORMED FROM A SHEET OF A MATERIAL, INPUTS AND METHODS FOR THE PRODUCTION OF
ATOMIZERS, CARTRIDGE FOR AN AEROSOL DELIVERY DEVICE AND METHOD FOR ASSEMBLING A CARTRIDGE FOR A
SMOKING ARTICLE

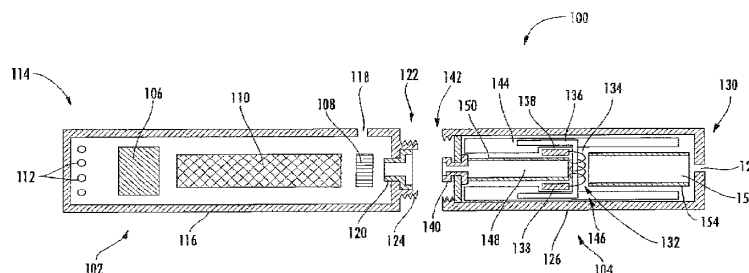


FIG. 1

(57) Abstract: The present disclosure relates to aerosol delivery devices such as smoking articles. An input for production of atom-
izers and atomizers formed from a sheet of a material are provided. The input may include a carrier and heating elements coupled
thereto. The heating elements may include ends and interconnected alternating loops disposed therebetween. The heating elements
may be coupled to a liquid transport element by bending the interconnected loops around the liquid transport element. The ends of
the heating element may be coupled to heater terminals. Further, a cartridge for an aerosol delivery device including a base, a reser-
voir substrate, and an atomizer is provided. The atomizer may comprise a liquid transport element and a heating element. The atom-
izer may extend through a cavity through the reservoir substrate such that the heating element is positioned proximate an end there-
of. Related methods are also provided.

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HEATING ELEMENTS FORMED FROM A SHEET OF A MATERIAL, INPUTS AND
METHODS FOR THE PRODUCTION OF ATOMIZERS, CARTRIDGE FOR AN AEROSOL
DELIVERY DEVICE AND METHOD FOR ASSEMBLING A CARTRIDGE FOR A SMOKING
ARTICLE

FIELD OF THE DISCLOSURE

The present disclosure relates to heating elements for atomizers, and more particularly to heating elements formed from a sheet of a material and further relates to a cartridge for aerosol delivery devices such as smoking articles, and more particularly to a cartridge for smoking articles including an atomizer received through a reservoir substrate.. The heating elements and atomizers
5 may be configured to heat an aerosol precursor, which may be made or derived from tobacco or otherwise incorporate tobacco, to form an inhalable substance for human consumption.

BACKGROUND

Many smoking devices have been proposed through the years as improvements upon, or
10 alternatives to, smoking products that require combusting tobacco for use. Many of those devices purportedly have been designed to provide the sensations associated with cigarette, cigar, or pipe smoking, but without delivering considerable quantities of incomplete combustion and pyrolysis products that result from the burning of tobacco. To this end, there have been proposed numerous smoking products, flavor generators, and medicinal inhalers that utilize electrical energy to
15 vaporize or heat a volatile material, or attempt to provide the sensations of cigarette, cigar, or pipe smoking without burning tobacco to a significant degree. See, for example, the various alternative smoking articles, aerosol delivery devices and heat generating sources set forth in the background art described in U.S. Pat. No. 7,726,320 to Robinson et al., U.S. Pat. App. Ser. No. 13/432,406, filed March 28, 2012, U.S. Pat. App. Ser. No. 13/536,438, filed June 28, 2012, U.S. Pat. App. Ser.
20 No. 13/602,871, filed September 4, 2012, and U.S. Pat. App. Ser. No. 13/647,000, filed October 8, 2012, which are incorporated herein by reference.

Certain tobacco products that have employed electrical energy to produce heat for smoke or aerosol formation, and in particular, certain products that have been referred to as electronic cigarette products, have been commercially available throughout the world. Representative
25 products that resemble many of the attributes of traditional types of cigarettes, cigars or pipes have been marketed as ACCORD® by Philip Morris Incorporated; ALPHA™, JOYE 510™ and M4™ by InnoVapor LLC; CIRRUS™ and FLING™ by White Cloud Cigarettes; COHITA™, COLIBRI™, ELITE CLASSIC™, MAGNUM™, PHANTOM™ and SENSE™ by Epuffer®

International Inc.; DUOPRO™, STORM™ and VAPORKING® by Electronic Cigarettes, Inc.; EGAR™ by Egar Australia; eGo-C™ and eGo-T™ by Joyetech; ELUSION™ by Elusion UK Ltd; EONSMOKE® by Eonsmoke LLC; GREEN SMOKE® by Green Smoke Inc. USA; GREENARETTE™ by Greenarette LLC; HALLIGAN™, HENDU™, JET™, MAXXQ™, 5 PINK™ and PITBULL™ by Smoke Stik®; HEATBAR™ by Philip Morris International, Inc.; HYDRO IMPERIAL™ and LXETM from Crown7; LOGIC™ and THE CUBAN™ by LOGIC Technology; LUCI® by Luciano Smokes Inc.; METRO® by Nicotek, LLC; NJOY® and ONEJOY™ by Sottera, Inc.; NO. 7™ by SS Choice LLC; PREMIUM ELECTRONIC CIGARETTE™ by PremiumEstore LLC; RAPP E-MYSTICK™ by Ruyan America, Inc.; RED 10 DRAGON™ by Red Dragon Products, LLC; RUYAN® by Ruyan Group (Holdings) Ltd.; SMART SMOKER® by The Smart Smoking Electronic Cigarette Company Ltd.; SMOKE ASSIST® by Coastline Products LLC; SMOKING EVERYWHERE® by Smoking Everywhere, Inc.; V2CIGS™ by VMR Products LLC; VAPOR NINE™ by VaporNine LLC; VAPOR4LIFE® by Vapor 4 Life, Inc.; VEPPOTM by E-CigaretteDirect, LLC and VUSE® by R. J. Reynolds Vapor Company. Yet 15 other electrically powered aerosol delivery devices, and in particular those devices that have been characterized as so-called electronic cigarettes, have been marketed under the tradenames BLU™; COOLER VISIONS™; DIRECT E-CIG™; DRAGONFLY™; EMIST™; EVERSMOKE™; GAMUCCI®; HYBRID FLAME™; KNIGHT STICKS™; ROYAL BLUES™; SMOKETIP® and SOUTH BEACH SMOKE™.

20 It would be desirable to provide a smoking article that employs heat produced by electrical energy to provide the sensations of cigarette, cigar, or pipe smoking, that does so without combusting tobacco to any significant degree, that does so without the need of a combustion heat source, and that does so without necessarily delivering considerable quantities of incomplete combustion and pyrolysis products. Thus, advances with respect to manufacturing electronic 25 smoking articles would be desirable.

BRIEF SUMMARY OF THE DISCLOSURE

The present disclosure relates to aerosol delivery devices configured to produce aerosol. In one aspect a cartridge for an aerosol delivery device such as a smoking article is provided. The 30 cartridge may include a base defining a connector end configured to engage a control body. The cartridge may additionally include a reservoir substrate configured to hold an aerosol precursor composition. The reservoir substrate may define a cavity extending therethrough from a first reservoir end to a second reservoir end, wherein the first reservoir end is positioned proximate the base. Further, the cartridge may include an atomizer. The atomizer may include a liquid transport

element extending between a first liquid transport element end and a second liquid transport element end and a heating element extending at least partially about the liquid transport element at a position between the first liquid transport element end and the second liquid transport element end. The atomizer may extend through the cavity of the reservoir substrate such that the heating element is positioned proximate the second reservoir end and the first liquid transport element end and the second liquid transport element end are positioned proximate the first reservoir end.

In some embodiments the atomizer may further include two heater terminals connected to the base and the heating element. The reservoir substrate may define a plurality of grooves at the cavity extending between the first reservoir end and the second reservoir end and configured to receive the liquid transport element. The cartridge may further comprise a retainer clip surrounding the atomizer and configured to retain the liquid transport element in contact with the heater terminals. The heater terminals may extend through the reservoir substrate.

In some embodiments the cartridge may further comprise an electronic control component and a control component terminal coupled thereto. The electronic control component may be received in the cavity of the reservoir substrate and the control component terminal may be connected to the base. The control component terminal and the heater terminals may extend to a plurality of different depths within the base. The heating element may include a wire defining a plurality of coils wound about the liquid transport element and extending between a first wire end and a second wire end.

In some embodiments the atomizer may additionally include two connector rings surrounding the heating element at the first wire end and the second wire end. The heater terminals may engage the connector rings. The heater terminals may directly contact the wire proximate the first wire end and the second wire end. A spacing of the coils of the wire may be less proximate the first wire end and the second wire end. In some embodiments the cartridge may further include a mouthpiece and an external shell.

In an additional aspect, a method for assembling a cartridge for an aerosol delivery device such as a smoking article is provided. The method may include providing a base defining a connector end configured to engage a control body, an atomizer, and a reservoir substrate configured to hold an aerosol precursor composition and defining a cavity extending therethrough from a first reservoir end to a second reservoir end, connecting the atomizer to the base, and inserting the atomizer through the cavity through the reservoir substrate.

In some embodiments the method may further include assembling the atomizer. Assembling the atomizer may include providing two heater terminals, a liquid transport element extending between a first liquid transport element end and a second liquid transport element end,

and a heating element. Assembling the atomizer may further include wrapping the heating element at least partially about the liquid transport element and connecting the heating element to the heater terminals such that the heating element extends therebetween and a first distal arm of the liquid transport element and a second distal arm of the liquid transport element extend along the heater terminals.

In some embodiments connecting the atomizer to the base may include connecting the heater terminals to the base. Inserting the atomizer through the cavity may include positioning the atomizer such that the heating element is proximate the second reservoir end, the first distal arm and the second distal arm of the liquid transport element and the heater terminals are at least partially received in the cavity, the first liquid transport element end and the second liquid transport element end are proximate the first reservoir end, and the first reservoir end of the reservoir substrate is proximate the base. Inserting the atomizer through the cavity may further include inserting the first distal arm and the second distal arm of the liquid transport element in a plurality of grooves extending between the first reservoir end and the second reservoir end of the reservoir substrate at the cavity.

In some embodiments the method may additionally include inserting the atomizer through a retainer clip configured to retain the liquid transport element in contact with the heater terminals. Further, the method may include providing an electronic control component and a control component terminal, connecting the control component terminal to the base, coupling the electronic control component to the control component terminal, and inserting the electronic control component into the cavity of the reservoir substrate. Connecting the control component terminal to the base and connecting the heater terminals to the base may include inserting the control component terminal and the heater terminals to a plurality of different heights within the base. Connecting the control component terminal to the base and coupling the electronic control component to the control component terminal may be conducted before connecting the heater terminals to the base.

In some embodiments wrapping the heating element at least partially about the liquid transport element may include winding a wire about the liquid transport element to define a plurality of coils wound about the liquid transport element extending between a first wire end and a second wire end. The method may further include coupling two connector rings to the heating element at the first wire end and the second wire end, wherein connecting the heating element to the heater terminals includes connecting the heater terminals to the connector rings. In another embodiment, connecting the heating element to the heater terminals may include connecting the heating element to the heater terminals directly. Winding the wire about the liquid transport

element to define the coils may include winding the wire such that a spacing of the coils of the wire is less proximate the first wire end and the second wire end. The method may additionally include providing an external shell and a mouthpiece and coupling the external shell to the base and coupling the mouthpiece to the external shell.

5 In an additional aspect an input for production of a plurality of atomizers is provided. The input may include a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier. The input may additionally include a plurality of heating elements that are coupled to the carrier and respectively received in the access windows. The carrier and the heating elements may be integrally formed from a sheet of a material.

10 In some embodiments the carrier may include a first side strip and a second side strip extending parallel to the longitudinal axis. A first end and a second end of each of the heating elements may be respectively coupled to one of the first side strip and the second side strip. At least one of the first side strip and the second side strip may define a plurality of apertures extending therethrough. The carrier may additionally include a plurality of connecting strips
15 extending between the first side strip and the second side strip and separating the access windows. A first end and a second end of each of the heating elements may be respectively coupled to one of the connecting strips.

In some embodiments the heating elements may define a plurality of longitudinal axes and each of the heating elements may include a plurality of interconnected loops oriented transversely to the longitudinal axes and alternately disposed with respect thereto. The longitudinal axes of
20 the heating elements may be coaxial with the longitudinal axis of the carrier. In an alternate embodiment the longitudinal axes of the heating elements may be perpendicular to the longitudinal axis of the carrier.

In an additional aspect, a heating element is provided. The heating element may include a
25 first end, a second end, and a plurality of interconnected loops coupled to the first end and the second end. The interconnected loops may be oriented transversely to a longitudinal axis extending between the first end and the second end and alternately disposed with respect thereto. The first end, the second end, and the plurality of interconnected loops may be integrally formed from a sheet of a material.

30 In some embodiments the interconnected loops may be bent toward one another. A plurality of tips of the interconnected loops may be positioned adjacent one another and the interconnected loops may define a substantially cylindrical void extending parallel to the longitudinal axis. The first end and the second end may define a width that is greater than a width of a band of the material defining the interconnected loops.

In an additional aspect, a method of forming a plurality of atomizers is provided. The method may include providing a sheet of a material. Further, the method may include forming the sheet of the material into a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier. The method may additionally include forming the sheet of the material into a plurality of heating elements that are coupled to the carrier and respectively received in the access windows.

In some embodiments, forming the sheet of the material into the carrier may include forming a first side strip and a second side strip extending parallel to the longitudinal axis. Forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements may include retaining a plurality of connections between a first end and a second end of the heating elements and the first side strip and the second side strip. Further, forming the sheet of the material into the carrier may include forming a plurality of apertures extending through at least one of the first side strip and the second side strip.

In some embodiments, forming the sheet of the material into the carrier may include forming a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows. Forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements may include retaining a plurality of connections between a first end and a second end of each of the heating elements and the connecting strips. Further, forming the sheet of the material into the heating elements may include forming a plurality of interconnected loops oriented transversely to a plurality of longitudinal axes of the heating elements. Forming the sheet of the material into the heating elements may include forming the heating elements such that the longitudinal axes thereof are coaxial with the longitudinal axis of the carrier. Forming the sheet of the material into the heating elements may include forming the heating elements such that the longitudinal axes thereof are perpendicular to the longitudinal axis of the carrier.

In some embodiments the method may additionally include providing a liquid transport element. The method may also include bending the interconnected loops about the liquid transport element such that a plurality of tips of the interconnected loops are positioned adjacent one another and the interconnected loops define a substantially cylindrical void extending parallel to the longitudinal axis of the carrier in which the liquid transport element is received. Additionally, the method may include decoupling the heating elements from the carrier. Further, the method may include connecting a first end and a second end of each of the heating elements to a plurality of heater terminals.

The invention includes, without limitation, the following embodiments.

Embodiment 1: An input for production of a plurality of atomizers, the input comprising:
a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the
carrier; and

5 a plurality of heating elements that are coupled to the carrier and respectively received in
the access windows,
wherein the carrier and the heating elements are integrally formed from a sheet of a
material.

Embodiment 2: The input for production of atomizers of any preceding or subsequent
embodiment, wherein the carrier comprises a first side strip and a second side strip extending
10 parallel to the longitudinal axis.

Embodiment 3: The input for production of atomizers of any preceding or subsequent
embodiment, wherein a first end and a second end of each of the heating elements are respectively
coupled to one of the first side strip and the second side strip.

Embodiment 4: The input for production of atomizers of any preceding or subsequent
15 embodiment, wherein at least one of the first side strip and the second side strip defines a plurality
of apertures extending therethrough.

Embodiment 5: The input for production of atomizers of any preceding or subsequent
embodiment, wherein the carrier further comprises a plurality of connecting strips extending
between the first side strip and the second side strip and separating the access windows.

20 Embodiment 6: The input for production of atomizers of any preceding or subsequent
embodiment, wherein a first end and a second end of each of the heating elements are respectively
coupled to one of the connecting strips.

Embodiment 7: The input for production of atomizers of any preceding or subsequent
embodiment, wherein the heating elements define a plurality of longitudinal axes and each of the
25 heating elements comprises a plurality of interconnected loops oriented transversely to the
longitudinal axes and alternately disposed with respect thereto.

Embodiment 8: The input for production of atomizers of any preceding or subsequent
embodiment, wherein the longitudinal axes of the heating elements are coaxial with the
longitudinal axis of the carrier.

30 Embodiment 9: The input for production of atomizers of any preceding or subsequent
embodiment, wherein the longitudinal axes of the heating elements are perpendicular to the
longitudinal axis of the carrier.

Embodiment 10: A heating element, comprising:
a first end;

a second end; and

a plurality of interconnected loops coupled to the first end and the second end, the interconnected loops being oriented transversely to a longitudinal axis extending between the first end and the second end and alternatingly disposed with respect thereto,

5 wherein the first end, the second end, and the plurality of interconnected loops are integrally formed from a sheet of a material.

Embodiment 11: The heating element of any preceding or subsequent embodiment, wherein the interconnected loops are bent toward one another.

Embodiment 12: The heating element of any preceding or subsequent embodiment,
10 wherein a plurality of tips of the interconnected loops are positioned adjacent one another and the interconnected loops define a substantially cylindrical void extending parallel to the longitudinal axis.

Embodiment 13: The heating element of any preceding or subsequent embodiment, wherein the first end and the second end define a width that is greater than a width of the material
15 defining the interconnected loops.

Embodiment 14: A method of forming a plurality of atomizers, comprising:
providing a sheet of a material;

forming the sheet of the material into a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier; and

20 forming the sheet of the material into a plurality of heating elements that are coupled to the carrier and respectively received in the access windows.

Embodiment 15: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the carrier comprises forming a first side strip and a second side strip extending parallel to the longitudinal axis.

25 Embodiment 16: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements comprises retaining a plurality of connections between a first end and a second end of the heating elements and the first side strip and the second side strip.

Embodiment 17: The method of any preceding or subsequent embodiment, wherein
30 forming the sheet of the material into the carrier comprises forming a plurality of apertures extending through at least one of the first side strip and the second side strip.

Embodiment 18: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the carrier comprises forming a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows.

Embodiment 19: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements comprises retaining a plurality of connections between a first end and a second end of each of the heating elements and the connecting strips.

5 Embodiment 20: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the heating elements comprises forming a plurality of interconnected loops oriented transversely to a plurality of longitudinal axes of the heating elements.

10 Embodiment 21: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the heating elements comprises forming the heating elements such that the longitudinal axes thereof are coaxial with the longitudinal axis of the carrier.

Embodiment 22: The method of any preceding or subsequent embodiment, wherein forming the sheet of the material into the heating elements comprises forming the heating elements such that the longitudinal axes thereof are perpendicular to the longitudinal axis of the carrier.

15 Embodiment 23: The method of any preceding or subsequent embodiment, further comprising providing a liquid transport element; and

bending the interconnected loops about the liquid transport element such that a plurality of tips of the interconnected loops are positioned adjacent one another and the interconnected loops define a substantially cylindrical void extending parallel to the longitudinal axis of the carrier in
20 which the liquid transport element is received.

Embodiment 24: The method of any preceding or subsequent embodiment, further comprising decoupling the heating elements from the carrier; and

connecting a first end and a second end of each of the heating elements to a plurality of heater terminals.

25 Embodiment 25: A cartridge for an aerosol delivery device, the cartridge comprising: a base defining a connector end configured to engage a control body;

a reservoir substrate configured to hold an aerosol precursor composition, the reservoir substrate defining a cavity extending therethrough from a first reservoir end to a second reservoir end, wherein the first reservoir end is positioned proximate the base; and

30 an atomizer comprising a liquid transport element extending between a first liquid transport element end and a second liquid transport element end and a heating element extending at least partially about the liquid transport element at a position between the first liquid transport element end and the second liquid transport element end, the atomizer extending through the cavity of the reservoir substrate such that the heating element is positioned proximate the second reservoir end

and the first liquid transport element end and the second liquid transport element end are positioned proximate the first reservoir end.

Embodiment 26: The cartridge of any preceding or subsequent embodiment, wherein the atomizer further comprises a plurality of heater terminals connected to the base and the heating
5 element.

Embodiment 27: The cartridge of any preceding or subsequent embodiment, wherein the reservoir substrate defines a plurality of grooves at the cavity extending between the first reservoir end and the second reservoir end and configured to receive the liquid transport element.

Embodiment 28: The cartridge of any preceding or subsequent embodiment, further
10 comprising a retainer clip surrounding the atomizer and configured to retain the liquid transport element in contact with the heater terminals.

Embodiment 29: The cartridge of any preceding or subsequent embodiment, wherein the heater terminals extend through the reservoir substrate.

Embodiment 30: The cartridge of any preceding or subsequent embodiment, further
15 comprising an electronic control component and a control component terminal coupled thereto, wherein the electronic control component is received in the cavity of the reservoir substrate and the control component terminal is connected to the base.

Embodiment 31: The cartridge of any preceding or subsequent embodiment, wherein the control component terminal and the heater terminals extend to a plurality of different depths within
20 the base.

Embodiment 32: The cartridge of any preceding or subsequent embodiment, wherein the heating element comprises a wire defining a plurality of coils wound about the liquid transport element extending between a first wire end and a second wire end.

Embodiment 33: The cartridge of any preceding or subsequent embodiment, wherein the
25 atomizer further comprises a plurality of connector rings surrounding the heating element at the first wire end and the second wire end, wherein the heater terminals engage the connector rings.

Embodiment 34: The cartridge of any preceding or subsequent embodiment, wherein the heater terminals directly contact the wire proximate the first wire end and the second wire end.

Embodiment 35: The cartridge of any preceding or subsequent embodiment, wherein a
30 spacing of the coils of the wire is less proximate the first wire end and the second wire end.

Embodiment 36: The cartridge of any preceding or subsequent embodiment, further comprising a mouthpiece and an external shell.

Embodiment 37: A method for assembling a cartridge for an aerosol delivery device, the method comprising:

providing a base defining a connector end configured to engage a control body, an atomizer, and a reservoir substrate configured to hold an aerosol precursor composition and defining a cavity extending therethrough from a first reservoir end to a second reservoir end;

connecting the atomizer to the base; and

5 inserting the atomizer through the cavity through the reservoir substrate.

Embodiment 38: The method of any preceding or subsequent embodiment, further comprising assembling the atomizer, wherein assembling the atomizer comprises:

providing a plurality of heater terminals, a liquid transport element extending between a first liquid transport element end and a second liquid transport element end, and a heating element;

10 wrapping the heating element at least partially about the liquid transport element; and

connecting the heating element to the heater terminals such that the heating element extends therebetween and a first distal arm of the liquid transport element and a second distal arm of the liquid transport element extend along the heater terminals.

Embodiment 39: The method of any preceding or subsequent embodiment, wherein
15 connecting the atomizer to the base comprises connecting the heater terminals to the base, and wherein inserting the atomizer through the cavity comprises positioning the atomizer such that the heating element is proximate the second reservoir end, the first distal arm and the second distal arm of the liquid transport element and the heater terminals are at least partially received in the cavity, the first liquid transport element end and the second liquid transport element end are
20 proximate the first reservoir end, and the first reservoir end of the reservoir substrate is proximate the base.

Embodiment 40: The method of any preceding or subsequent embodiment, wherein inserting the atomizer through the cavity further comprises inserting the first distal arm and the second distal arm of the liquid transport element in a plurality of grooves extending between the
25 first reservoir end and the second reservoir end of the reservoir substrate at the cavity.

Embodiment 41: The method of any preceding or subsequent embodiment, further comprising inserting the atomizer through a retainer clip configured to retain the liquid transport element in contact with the heater terminals.

Embodiment 42: The method of any preceding or subsequent embodiment, further
30 comprising providing an electronic control component and a control component terminal; connecting the control component terminal to the base; coupling the electronic control component to the control component terminal; and inserting the electronic control component into the cavity of the reservoir substrate.

Embodiment 43: The method of any preceding or subsequent embodiment, wherein connecting the control component terminal to the base and connecting the heater terminals to the base comprise inserting the control component terminal and the heater terminals to a plurality of different heights within the base.

5 Embodiment 44: The method of any preceding or subsequent embodiment, wherein connecting the control component terminal to the base and coupling the electronic control component to the control component terminal are conducted before connecting the heater terminals to the base.

10 Embodiment 45: The method of any preceding or subsequent embodiment wherein wrapping the heating element at least partially about the liquid transport element comprises winding a wire about the liquid transport element to define a plurality of coils wound about the liquid transport element extending between a first wire end and a second wire end.

15 Embodiment 46: The method of any preceding or subsequent embodiment, further comprising coupling a plurality of connector rings to the heating element at the first wire end and the second wire end, wherein connecting the heating element to the heater terminals comprises connecting the heater terminals to the connector rings.

Embodiment 47: The method of any preceding or subsequent embodiment, wherein connecting the heating element to the heater terminals comprises connecting the heating element to the heater terminals directly.

20 Embodiment 48: The method of any preceding or subsequent embodiment, wherein winding the wire about the liquid transport element to define the coils comprises winding the wire such that a spacing of the coils of the wire is less proximate the first wire end and the second wire end.

25 Embodiment 49: The method of any preceding or subsequent embodiment, further comprising providing an external shell and a mouthpiece; and coupling the external shell to the base and coupling the mouthpiece to the external shell.

30 These and other features, aspects, and advantages of the disclosure will be apparent from a reading of the following detailed description together with the accompanying drawings, which are briefly described below. The invention includes any combination of two, three, four, or more of the above-noted embodiments as well as combinations of any two, three, four, or more features or elements set forth in this disclosure, regardless of whether such features or elements are expressly combined in a specific embodiment description herein. This disclosure is intended to be read holistically such that any separable features or elements of the disclosed invention, in any of its

various aspects and embodiments, should be viewed as intended to be combinable unless the context clearly dictates otherwise.

BRIEF DESCRIPTION OF THE FIGURES

5 Having thus described the disclosure in the foregoing general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a sectional view through a smoking article comprising a control body and a cartridge including an atomizer according to an example embodiment of the present disclosure;

10 FIG. 2 illustrates an exploded view of a cartridge for a smoking article comprising a base, a control component terminal, an electronic control component, an atomizer, a reservoir substrate, an external shell, and a mouthpiece according to an example embodiment of the present disclosure;

FIG. 3 illustrates an enlarged exploded view of the base and the control component terminal of the cartridge of FIG. 2;

15 FIG. 4 illustrates an enlarged perspective view of the base and the control component terminal of FIG. 2 in an assembled configuration;

FIG. 5 illustrates an enlarged perspective view of the base, the control component terminal, and the electronic control component of FIG. 2 in an assembled configuration;

FIG. 6 illustrates an enlarged perspective view of the atomizer of FIG. 2;

20 FIG. 7 illustrates an enlarged side perspective view of the base, the control component terminal, the electronic control component, and the atomizer of FIG. 2 in an assembled configuration;

FIG. 8 illustrates an enlarged bottom perspective view of the base, the control component terminal, the electronic control component, and the atomizer of FIG. 2 in an assembled configuration;

25 FIG. 9 illustrates a perspective view of the base, the atomizer, and the reservoir substrate of FIG. 2 in an assembled configuration;

FIG. 10 illustrates a perspective view of the base and the external shell of FIG. 2 in an assembled configuration;

30 FIG. 11 illustrates a perspective view of the cartridge of FIG. 2 in an assembled configuration;

FIG. 12 illustrates a first partial perspective view of the cartridge of FIG. 2 and a receptacle for a control body according to an example embodiment of the present disclosure;

FIG. 13 illustrates an opposing second partial perspective view of the cartridge of FIG. 2 and the receptacle of FIG. 12;

FIG. 14 illustrates an exploded view of a cartridge for a smoking article comprising a base, a control component terminal, an electronic control component, an atomizer, a retainer clip, a reservoir substrate, an external shell, and a mouthpiece according to an example embodiment of the present disclosure;

5 FIG. 15 illustrates an enlarged perspective view of the base, the control component terminal, and the heater terminals of the cartridge of FIG. 14 in an assembled configuration;

FIG. 16 illustrates an enlarged perspective view of the base, the control component terminal, the heater terminals, and the atomizer of the cartridge of FIG. 14 in an assembled configuration;

10 FIG. 17 illustrates a partial perspective view of the cartridge of FIG. 14 further comprising a flow tube according to an example embodiment of the present disclosure;

FIG. 18 illustrates an end view of the flow tube of FIG. 17;

FIG. 19 illustrates a perspective view of a truncated side of the flow tube;

FIG. 20 illustrates a perspective view of an elongated side of the flow tube;

15 FIG. 21 illustrates a perspective view of a liquid transport element with a wire heating element and connector rings received thereon according to an example embodiment of the present disclosure;

FIG. 22 illustrates a perspective view of an atomizer comprising the liquid transport element with the wire heating element and the connector rings received thereon of FIG. 21;

20 FIG. 23 illustrates a partially exploded view of an aerosol delivery device including a control body in a assembled configuration and a cartridge in an exploded configuration, the cartridge comprising a base shipping plug, a base, a control component terminal, an electronic control component, a flow tube, an atomizer, a reservoir substrate, an external shell, a label, a mouthpiece, and a mouthpiece shipping plug according to an example embodiment of the present disclosure;

FIG. 24 illustrates an enlarged perspective view of the base, the atomizer, the flow tube, and the reservoir substrate of FIG. 23 in an assembled configuration;

FIG. 25 illustrates a schematic view of a method for assembling a cartridge for a smoking article according to an example embodiment of the present disclosure;

30 FIG. 26 illustrates a partial perspective view of an input for production of a plurality of atomizers comprising a carrier and a plurality of heating elements coupled to connecting strips of the carrier according to an example embodiment of the present disclosure;

FIG. 27 illustrates an enlarged top view of one of the heating elements of the input of FIG. 20 in an initial planar configuration;

FIG. 28 illustrates an enlarged perspective view of one of the heating elements of the input of FIG. 26 in a bent configuration;

FIG. 29 illustrates a partial perspective view of an input for production of a plurality of atomizers comprising a carrier and a plurality of heating elements coupled to side strips of the carrier according to an example embodiment of the present disclosure;

FIG. 30 illustrates steps performed in producing atomizers from the input of FIG. 29 according to an example embodiment of the present disclosure; and

FIG. 31 illustrates a schematic view of a method of forming a plurality of atomizers according to an example embodiment of the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The present disclosure will now be described more fully hereinafter with reference to exemplary embodiments thereof. These exemplary embodiments are described so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Indeed, the disclosure may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. As used in the specification, and in the appended claims, the singular forms “a”, “an”, “the”, include plural referents unless the context clearly dictates otherwise.

The present disclosure provides descriptions of aerosol delivery devices that use electrical energy to heat a material (preferably without combusting the material to any significant degree) to form an inhalable substance; such articles most preferably being sufficiently compact to be considered “hand-held” devices. In certain highly preferred embodiments, the aerosol delivery devices can be characterized as smoking articles. As used herein, the term “smoking article” is intended to mean an article or device that provides some or all of the sensations (e.g., inhalation and exhalation rituals, types of tastes or flavors, organoleptic effects, physical feel, use rituals, visual cues such as those provided by visible aerosol, and the like) of smoking a cigarette, cigar, or pipe, without any substantial degree of combustion of any component of that article or device. As used herein, the term “smoking article” does not necessarily mean that, in operation, the article or device produces smoke in the sense of the aerosol resulting from by-products of combustion or pyrolysis of tobacco, but rather, that the article or device yields vapors (including vapors within aerosols that can be considered to be visible aerosols that might be considered to be described as smoke-like) resulting from volatilization or vaporization of certain components of the article or

device. In highly preferred embodiments, articles or devices characterized as smoking articles incorporate tobacco and/or components derived from tobacco.

Articles or devices of the present disclosure also can be characterized as being vapor-producing articles, aerosol delivery articles or medicament delivery articles. Thus, such articles or devices can be adapted so as to provide one or more substances (e.g., flavors and/or pharmaceutical active ingredients) in an inhalable form or state. For example, inhalable substances can be substantially in the form of a vapor (i.e., a substance that is in the gas phase at a temperature lower than its critical point). Alternatively, inhalable substances can be in the form of an aerosol (i.e., a suspension of fine solid particles or liquid droplets in a gas). For purposes of simplicity, the term “aerosol” as used herein is meant to include vapors, gases and aerosols of a form or type suitable for human inhalation, whether or not visible, and whether or not of a form that might be considered to be smoke-like.

In use, smoking articles of the present disclosure may be subjected to many of the physical actions employed by an individual in using a traditional type of smoking article (e.g., a cigarette, cigar or pipe that is employed by lighting and inhaling tobacco). For example, the user of a smoking article of the present disclosure can hold that article much like a traditional type of smoking article, draw on one end of that article for inhalation of aerosol produced by that article, take puffs at selected intervals of time, etc.

Smoking articles of the present disclosure generally include a number of components provided within an outer shell or body. The overall design of the outer shell or body can vary, and the format or configuration of the outer body that can define the overall size and shape of the smoking article can vary. Typically, an elongated body resembling the shape of a cigarette or cigar can be formed from a single, unitary shell; or the elongated body can be formed of two or more separable pieces. For example, a smoking article can comprise an elongated shell or body that can be substantially tubular in shape and, as such, resemble the shape of a conventional cigarette or cigar. In one embodiment, all of the components of the smoking article are contained within one outer body or shell. Alternatively, a smoking article can comprise two or more shells that are joined and are separable. For example, a smoking article can possess at one end a control body comprising a shell containing one or more reusable components (e.g., a rechargeable battery and various electronics for controlling the operation of that article), and at the other end and removably attached thereto a shell containing a disposable portion (e.g., a disposable flavor-containing cartridge). More specific formats, configurations and arrangements of components within the single shell type of unit or within a multi-piece separable shell type of unit will be evident in light of the further disclosure provided herein. Additionally, various smoking article designs and

component arrangements can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

Smoking articles of the present disclosure most preferably comprise some combination of a power source (i.e., an electrical power source), at least one control component (e.g., means for actuating, controlling, regulating and ceasing power for heat generation, such as by controlling electrical current flow the power source to other components of the article), a heater or heat generation component (e.g., an electrical resistance heating element or component commonly referred to as an “atomizer”), and an aerosol precursor composition (e.g., commonly a liquid capable of yielding an aerosol upon application of sufficient heat, such as ingredients commonly referred to as “smoke juice,” “e-liquid” and “e-juice”), and a mouthend region or tip for allowing draw upon the smoking article for aerosol inhalation (e.g., a defined air flow path through the article such that aerosol generated can be withdrawn therefrom upon draw). Exemplary formulations for aerosol precursor materials that may be used according to the present disclosure are described in U.S. Pat. Pub. No. 2013/0008457 to Zheng et al., the disclosure of which is incorporated herein by reference in its entirety.

Alignment of the components within the article can vary. In specific embodiments, the aerosol precursor composition can be located near an end of the article (e.g., within a cartridge, which in certain circumstances can be replaceable and disposable), which may be proximal to the mouth of a user so as to maximize aerosol delivery to the user. Other configurations, however, are not excluded. Generally, the heating element can be positioned sufficiently near the aerosol precursor composition so that heat from the heating element can volatilize the aerosol precursor (as well as one or more flavorants, medicaments, or the like that may likewise be provided for delivery to a user) and form an aerosol for delivery to the user. When the heating element heats the aerosol precursor composition, an aerosol is formed, released, or generated in a physical form suitable for inhalation by a consumer. It should be noted that the foregoing terms are meant to be interchangeable such that reference to release, releasing, releases, or released includes form or generate, forming or generating, forms or generates, and formed or generated. Specifically, an inhalable substance is released in the form of a vapor or aerosol or mixture thereof. Additionally, the selection of various smoking article components can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

A smoking article incorporates a battery or other electrical power source to provide current flow sufficient to provide various functionalities to the article, such as resistive heating, powering

of control systems, powering of indicators, and the like. The power source can take on various embodiments. Preferably, the power source is able to deliver sufficient power to rapidly heat the heating member to provide for aerosol formation and power the article through use for the desired duration of time. The power source preferably is sized to fit conveniently within the article so that
5 the article can be easily handled; and additionally, a preferred power source is of a sufficiently light weight to not detract from a desirable smoking experience.

One example embodiment of a smoking article 100 is provided in FIG. 1. As seen in the cross-section illustrated therein, the smoking article 100 can comprise a control body 102 and a cartridge 104 that can be permanently or detachably aligned in a functioning relationship.
10 Although a threaded engagement is illustrated in FIG. 1, it is understood that further means of engagement are encompassed, such as a press-fit engagement, interference fit, a magnetic engagement, or the like.

In specific embodiments, one or both of the control body 102 and the cartridge 104 may be referred to as being disposable or as being reusable. For example, the control body may have a
15 replaceable battery or may be rechargeable and thus may be combined with any type of recharging technology, including connection to a typical electrical outlet, connection to a car charger (i.e., cigarette lighter receptacle), and connection to a computer, such as through a USB cable.

In the exemplified embodiment, the control body 102 includes a control component 106, a flow sensor 108, and a battery 110, which can be variably aligned, and can include a plurality of
20 indicators 112 at a distal end 114 of an external shell 116. The indicators 112 can be provided in varying numbers and can take on different shapes and can even be an opening in the body (such as for release of sound when such indicators are present).

An air intake 118 may be positioned in the external shell 116 of the control body 102. A receptacle 120 also is included at the proximal attachment end 122 of the control body 102 and
25 extends into a control body projection 124 to allow for ease of electrical connection with an atomizer or a component thereof, such as a resistive heating element (described below) when the cartridge 104 is attached to the control body.

The cartridge 104 includes an external shell 126 with a mouth opening 128 at a mouthend 130 thereof to allow passage of air and entrained vapor (i.e., the components of the aerosol
30 precursor composition in an inhalable form) from the cartridge to a consumer during draw on the smoking article 100. The smoking article 100 may be substantially rod-like or substantially tubular shaped or substantially cylindrically shaped in some embodiments.

The cartridge 104 further includes an atomizer 132 comprising a resistive heating element 134 comprising a wire coil in the illustrated embodiment and a liquid transport element 136

comprising a wick in the illustrated embodiment and configured to transport a liquid. Various embodiments of materials configured to produce heat when electrical current is applied therethrough may be employed to form the wire coil. Example materials from which the wire coil may be formed include Kanthal (FeCrAl), Nichrome, Molybdenum disilicide (MoSi_2),
5 molybdenum silicide (MoSi), Molybdenum disilicide doped with Aluminum ($\text{Mo}(\text{Si},\text{Al})_2$), and ceramic (e.g., a positive temperature coefficient ceramic). Electrically conductive heater terminals 138 (e.g., positive and negative terminals) at the opposing ends of the heating element 134 are configured to direct current flow through the heating element and configured for attachment to the appropriate wiring or circuit (not illustrated) to form an electrical connection of the heating element
10 with the battery 110 when the cartridge 104 is connected to the control body 102. Specifically, a plug 140 may be positioned at a distal attachment end 142 of the cartridge 104. When the cartridge 104 is connected to the control body 102, the plug 140 engages the receptacle 120 to form an electrical connection such that current controllably flows from the battery 110, through the receptacle and plug, and to the heating element 134. The external shell 126 of the cartridge 104 can
15 continue across the distal attachment end 142 such that this end of the cartridge is substantially closed with the plug protruding therefrom.

A reservoir may utilize a liquid transport element to transport an aerosol precursor composition to an aerosolization zone. One such example is shown in FIG. 1. As seen therein, the cartridge 104 includes a reservoir layer 144 comprising layers of nonwoven fibers formed into the
20 shape of a tube encircling the interior of the external shell 126 of the cartridge, in this embodiment. An aerosol precursor composition is retained in the reservoir layer 144. Liquid components, for example, can be sorptively retained by the reservoir layer 144. The reservoir layer 144 is in fluid connection with a liquid transport element 136 (the wick in this embodiment). The liquid transport element 136 transports the aerosol precursor composition stored in the reservoir layer 144 via
25 capillary action to an aerosolization zone 146 of the cartridge 104. As illustrated, the liquid transport element 136 is in direct contact with the heating element 134 that is in the form of a metal wire coil in this embodiment.

In use, when a user draws on the article 100, the heating element 134 is activated (e.g., such as via a puff sensor), and the components for the aerosol precursor composition are vaporized in the
30 aerosolization zone 146. Drawing upon the mouthend 130 of the article 100 causes ambient air to enter the air intake 118 and pass through the central opening in the receptacle 120 and the central opening in the plug 140. In the cartridge 104, the drawn air passes through an air passage 148 in an air passage tube 150 and combines with the formed vapor in the aerosolization zone 146 to form an aerosol. The aerosol is whisked away from the aerosolization zone 146, passes through an air

passage 152 in an air passage tube 154, and out the mouth opening 128 in the mouthend 130 of the article 100.

It is understood that a smoking article that can be manufactured according to the present disclosure can encompass a variety of combinations of components useful in forming an electronic smoking article. Reference is made for example to the smoking articles disclosed in U.S. Pat. App. Serial No. 13/536,438, filed June 28, 2012, U.S. Pat. App. Serial No. 13/432,406, filed March 28, 2012, U.S. Pat. App. Serial No. 13/602,871, filed September 4, 2012, the disclosures of which are incorporated herein by reference in their entirety. Further to the above, representative heating elements and materials for use therein are described in U.S. Pat. No. 5,060,671 to Counts et al.; U.S. Pat. No. 5,093,894 to Deevi et al.; U.S. Pat. No. 5,224,498 to Deevi et al.; U.S. Pat. No. 5,228,460 to Sprinkel Jr., et al.; U.S. Pat. No. 5,322,075 to Deevi et al.; U.S. Pat. No. 5,353,813 to Deevi et al.; U.S. Pat. No. 5,468,936 to Deevi et al.; U.S. Pat. No. 5,498,850 to Das; U.S. Pat. No. 5,659,656 to Das; U.S. Pat. No. 5,498,855 to Deevi et al.; U.S. Pat. No. 5,530,225 to Hajaligol; U.S. Pat. No. 5,665,262 to Hajaligol; U.S. Pat. No. 5,573,692 to Das et al.; and U.S. Pat. No. 5,591,368 to Fleischhauer et al., the disclosures of which are incorporated herein by reference in their entirety. Further, a single-use cartridge for use with an electronic smoking article is disclosed in U.S. Pat. App. Serial No. 13/603,612, filed September 5, 2012, which is incorporated herein by reference in its entirety.

The various components of a smoking article according to the present disclosure can be chosen from components described in the art and commercially available. Examples of batteries that can be used according to the disclosure are described in U.S. Pat. App. Pub. No. 2010/0028766, the disclosure of which is incorporated herein by reference in its entirety.

An exemplary mechanism that can provide puff-actuation capability includes a Model 163PC01D36 silicon sensor, manufactured by the MicroSwitch division of Honeywell, Inc., Freeport, Ill. Further examples of demand-operated electrical switches that may be employed in a heating circuit according to the present disclosure are described in U.S. Pat. No. 4,735,217 to Gerth et al., which is incorporated herein by reference in its entirety. Further description of current regulating circuits and other control components, including microcontrollers that can be useful in the present smoking article, are provided in U.S. Pat. Nos. 4,922,901, 4,947,874, and 4,947,875, all to Brooks et al., U.S. Pat. No. 5,372,148 to McCafferty et al., U.S. Pat. No. 6,040,560 to Fleischhauer et al., and U.S. Pat. No. 7,040,314 to Nguyen et al., all of which are incorporated herein by reference in their entirety.

The aerosol precursor, which may also be referred to as an aerosol precursor composition or a vapor precursor composition, can comprise one or more different components. For example, the

aerosol precursor can include a polyhydric alcohol (e.g., glycerin, propylene glycol, or a mixture thereof). Representative types of further aerosol precursor compositions are set forth in U.S. Pat. No. 4,793,365 to Sensabaugh, Jr. et al.; U.S. Pat. No. 5,101,839 to Jakob et al.; PCT WO 98/57556 to Biggs et al.; and Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company Monograph (1988); the disclosures of which
5 are incorporated herein by reference.

Still further components can be utilized in the smoking article of the present disclosure. For example, U.S. Pat. No. 5,261,424 to Sprinkel, Jr. discloses piezoelectric sensors that can be associated with the mouth-end of a device to detect user lip activity associated with taking a draw
10 and then trigger heating; U.S. Pat. No. 5,372,148 to McCafferty et al. discloses a puff sensor for controlling energy flow into a heating load array in response to pressure drop through a mouthpiece; U.S. Pat. No. 5,967,148 to Harris et al. discloses receptacles in a smoking device that include an identifier that detects a non-uniformity in infrared transmissivity of an inserted component and a controller that executes a detection routine as the component is inserted into the
15 receptacle; U.S. Pat. No. 6,040,560 to Fleischhauer et al. describes a defined executable power cycle with multiple differential phases; U.S. Pat. No. 5,934,289 to Watkins et al. discloses photonic-optronic components; U.S. Pat. No. 5,954,979 to Counts et al. discloses means for altering draw resistance through a smoking device; U.S. Pat. No. 6,803,545 to Blake et al. discloses specific battery configurations for use in smoking devices; U.S. Pat. No. 7,293,565 to Griffen et al.
20 discloses various charging systems for use with smoking devices; U.S. Pat. App. Pub. No. 2009/0320863 by Fernando et al. discloses computer interfacing means for smoking devices to facilitate charging and allow computer control of the device; U.S. Pat. App. Pub. No. 2010/0163063 by Fernando et al. discloses identification systems for smoking devices; and WO 2010/003480 by Flick discloses a fluid flow sensing system indicative of a puff in an aerosol
25 generating system; all of the foregoing disclosures being incorporated herein by reference in their entireties. Further examples of components related to electronic aerosol delivery articles and disclosing materials or components that may be used in the present article include U.S. Pat. No. 4,735,217 to Gerth et al.; U.S. Pat. No. 5,249,586 to Morgan et al.; U.S. Pat. No. 5,666,977 to Higgins et al.; U.S. Pat. No. 6,053,176 to Adams et al.; U.S. 6,164,287 to White; U.S. Pat. No.
30 6,196,218 to Voges; U.S. Pat. No. 6,810,883 to Felter et al.; U.S. Pat. No. 6,854,461 to Nichols; U.S. Pat. No. 7,832,410 to Hon; U.S. Pat. No. 7,513,253 to Kobayashi; U.S. Pat. No. 7,896,006 to Hamano; U.S. Pat. No. 6,772,756 to Shayan; U.S. Pat. No. 8,156,944 to Hon; U.S. Pat. App. Pub. Nos. 2006/0196518, 2009/0126745, and 2009/0188490 to Hon; U.S. Pat. App. Pub. No. 2009/0272379 to Thorens et al.; U.S. Pat. App. Pub. Nos. 2009/0260641 and 2009/0260642 to

Monsees et al.; U.S. Pat. App. Pub. Nos. 2008/0149118 and 2010/0024834 to Oglesby et al.; U.S. Pat. App. Pub. No. 2010/0307518 to Wang; and WO 2010/091593 to Hon. A variety of the materials disclosed by the foregoing documents may be incorporated into the present devices in various embodiments, and all of the foregoing disclosures are incorporated herein by reference in
5 their entirety.

FIG. 2 illustrates an exploded view of an example embodiment of a cartridge 200 for a smoking article according to the present disclosure. The cartridge 200 may comprise a base 202, a control component terminal 204, an electronic control component 206, an atomizer 208, a reservoir substrate 210, an external shell 212, and a mouthpiece 214. The cartridge 200 may be configured
10 to couple to a control body to form a smoking article. Note that the various embodiments of components described above in the cited references and/or included in commercially available aerosol delivery devices may be employed in embodiments of the cartridges described here. Note further that some of these portions of the cartridge 200 are optional. In this regard, by way of example, the cartridge 200 may not include the control component terminal 204 and the electronic
15 control component 206 in some embodiments.

FIG. 3 illustrates an enlarged exploded view of the base 202 and the control component terminal 204. The control component terminal 204 may define a clip 216 configured to engage the electronic control component 206 and form an electrical connection therewith. Further, the control component terminal 204 may include one or more protrusions 218a, 218b configured to engage the
20 base 202, for example via interference fit, such that the control component terminal 204 is retained in engagement therewith. An end 220 of the control component terminal 204 may be configured to engage a control body, so as to establish an electrical connection therewith.

As illustrated, the base 202 may define a receptacle 222 configured to receive the control component terminal 204 therein. In this regard, as illustrated in FIG. 4, the control component
25 terminal 204 may couple to the base 202. For example, the control component terminal 204 may be retained in the receptacle 222 of the base 202 via interference fit, for example due to contact between the protrusions 218a, 218b and the base. As described below, the control component terminal 204 may extend through the base 202 to a position at which it may form an electrical connection with a control body to which the cartridge 200 connects. Further, the base 202 may
30 define threads or protrusions 224 configured to engage the external shell 212, as will be described below.

As illustrated in FIG. 5, the control component terminal 204 may couple to the electronic control component 206 such that an electrical connection is established therebetween. Accordingly, when the cartridge 200 is coupled to a control body, the electronic control component

206 may communicate therewith through the control component terminal 204. The electronic control component 206 may be configured to perform one or more of a variety of functions. Further, the electronic control component 206 may be configured as purpose-specific analog and/or digital circuitry with or without a processor, or the electronic control component may comprise

5 hardware, software, or a combination of hardware and software. Accordingly, any or all of the functions performed by or in conjunction with the electronic control component 206 may be embodied in a computer-readable storage medium having computer-readable program code portions stored therein that, in response to execution by a processor, cause an apparatus to at least perform or direct the recited functions. In one particular instance, upon establishment of

10 communication between the electronic control component 206 and a control body, the electronic control component may be configured to provide an authentication code or other appropriate indicia to the control body. In such instances, the control body may be configured to evaluate the authentication indicia to determine whether the cartridge 200 is authorized for use with the control body. However, the electronic control component 206 may perform various other functions.

15 Various examples of electronic control components and functions performed thereby are described in U.S. Pat. App. Ser. No. 13/647,000, filed October 8, 2012, which is incorporated herein by reference in its entirety.

FIG. 6 illustrates an enlarged perspective view of the atomizer 208. As illustrated, the atomizer 208 may include a liquid transport element 226, a heating element 228, a first heater

20 terminal 230a and a second heater terminal 230b (collectively, "heater terminals 230"). The liquid transport element 226 extends between a first liquid transport element end 232a and a second liquid transport element end 232b (collectively, "liquid transport element ends 232"). The liquid transport element 226 may comprise a wick in some embodiments, as described above.

The heating element 228 extends at least partially about the liquid transport element 226 at a

25 position between the first liquid transport element end 232a and the second liquid transport element end 232b. In some embodiments, the heating element 228 may comprise a wire 234 defining a plurality of coils wound about the liquid transport element 226 and extending between a first wire end 236a and a second wire end 236b (collectively, "wire ends 236"), as illustrated in FIGS. 6 and 8. The wire 234 may comprise material configured to produce heat when electrical current is

30 provided therethrough. For example, the wire 234 may comprise Kanthal (FeCrAl), Nichrome, Molybdenum disilicide (MoSi₂), molybdenum silicide (MoSi), Molybdenum disilicide doped with Aluminum (Mo(Si,Al)₂), or ceramic (e.g., a positive temperature coefficient ceramic) in some embodiments, although various other materials may be employed in other embodiments. In some embodiments the heating element 228 may be formed by winding the wire 234 about the liquid

transport element 226 as described in U.S. Pat. App. Ser. No. 13/708,381, filed December 7, 2012, which is incorporated herein by reference in its entirety. However, various other embodiments of methods may be employed to form the heating element 228, and various other embodiments of heating elements may be employed in the atomizer 208.

5 The heater terminals 230 connect to the heating element 228. In one embodiment the heater terminals 230 directly contact the wire 234 proximate the first wire end 236a and the second wire end 236b. Direct contact, as used herein, refers to physical contact between the wire 234 and the heater terminals 230. However, direct contact, as used herein, also encompasses embodiments in which one or more welds 238a, 238b couple the wire 234 and the heater terminals 230 (see, e.g.,
10 FIGS. 6 and 8). A weld, as used herein, refers to a solder, flux, braze, or other material that is deposited in liquid or molten form and hardens to form a connection.

As further illustrated in FIG. 6, the liquid transport element 226 may be configured in a substantially U-shaped configuration. Accordingly, a first distal arm 240a and a second distal arm 240b (collectively, “distal arms 240”) of the liquid transport element 226 may respectively extend
15 along the first and second heater terminals 230a, 230b. Further a center section 240c of the liquid transport element 226, at which the heating element 228 is positioned, may extend between the heater terminals 230. The liquid transport element 226 may be either preformed in the U-shaped configuration or bent to define this configuration.

The heater terminals 230 may define a plurality of walls 242. The walls 242 may include an
20 inner wall 242a, and two side walls 242b, 242c. Accordingly, the distal arms 240 of the liquid transport element 226 may be surrounded on three sides by the walls 242 of the heater terminals 230. This configuration may assist in retaining the heater terminals 230 in contact with the distal arms 240 of the liquid transport element 226. Further, the heater terminals 230 may define a first tab 244a and a second tab 244b (collectively, “tabs 244”) to which the first wire end 236a and the
25 second wire end 236b may be welded or otherwise connected. The heater terminals 230 may also include protrusions 246a, 246b configured to engage the base 202, for example via interference fit, such that the atomizer 208 is retained in engagement therewith. Ends 248a, 248b of the heater terminals 230 may be configured to engage a control body, so as to establish an electrical connection therewith.

30 As illustrated in FIG. 7, the heater terminals 230 may couple to the base 202 in addition to the heating element 228. Accordingly, the atomizer 208 may be connected to the base 202 via the heater terminals 230. The electronic control component 206 may be received between the heater terminals 230 and the liquid transport element ends 232. This configuration may allow the heater terminals 230 to provide support to the electronic control component 206, for example by contact

therewith, such that the electronic control component is securely retained in place. However, a gap 250 may be provided between the electronic control component 206 and the heating element 228. The gap 250 may reduce the amount of heat transferred to the electronic control component 206 from the heating element 228, for example by preventing direct conduction therebetween.

- 5 Accordingly, the risk of damage to the electronic control component 206 from excessive heat received from the heating element 228 may be reduced.

FIG. 8 illustrates an alternative perspective view of the base 202, the control component terminal 204, the electronic control component 206, and the atomizer 208 after they are coupled to one another. In particular, FIG. 8 illustrates a view of a connector end 252 of the base 202. As
10 illustrated, a central opening 254 may be defined in the base 202. The central opening 254 may be configured to receive airflow therethrough from a control body and direct the airflow toward the heating element 228 of the atomizer 208.

Further, the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230 may be exposed at the connector end 252 of the base 202. The end 220 of the
15 control component terminal 204 and the ends 248a, 248b of the heater terminals 230 may be located at differing positions within the base 202 such that they make connections with components at different locations within the control body, and avoid unintended contact therebetween. In this regard, the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230 may be located at differing radial distances from the central opening 254. In the
20 illustrated embodiment, the end 220 of the control component terminal 204 is located closest to the central opening 254, the first end 248a of the first heater terminal 230a is located farthest from the central opening, and the second end 248b of the second heater terminal 230b is located at a radial distance therebetween. Further, the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230 may extend to a plurality of different depths within the base
25 202. In the illustrated embodiment, the end 220 of the control component terminal 204 extends through the base 202 to a greatest depth, the first end 248a of the first heater terminal 230a extends through the base to the smallest depth, and the second end 248b of the second heater terminal 230b extends through the base to a depth therebetween.

FIG. 9 illustrates the assembly of FIGS. 7 and 8 after the reservoir substrate 210 is coupled
30 thereto. The reservoir substrate 210 may be configured to hold an aerosol precursor composition. The reservoir substrate 210 may define a cavity 256 extending therethrough from a first reservoir end 258a to a second reservoir end 258b, wherein the first reservoir end is positioned proximate the base 202. In this regard, the reservoir substrate 210 may define a hollow tubular configuration. Note that although generally described herein as defining a hollow tubular configuration, the

reservoir substrate 210 may define other shapes and configurations in other embodiments. The aerosol precursor composition may be retained within the material defining the reservoir substrate 210 itself, as opposed to within the cavity 256. This configuration may allow for airflow through the base, into and through the cavity 256, and past the heating element 228.

5 The reservoir substrate 210 can comprise various different materials and can be formed in a variety of different manners. In one embodiment the reservoir substrate 210 can be formed from a plurality of combined layers that can be concentric or overlapping. For example, the reservoir substrate 210 can be a continuous sheet of a material that is rolled to form the hollow tubular configuration. In other embodiments, the reservoir substrate 210 can be substantially a unitary
10 component. For example, the reservoir substrate 210 can be shaped or molded so as to be a singular preformed element in the form of a substantially hollow tube, which may be substantially continuous in composition across the length and thickness thereof.

 The reservoir substrate 210 can be formed from a material that is rigid or semi-rigid in some embodiments, while retaining the ability to store a liquid product such as, for example, an aerosol
15 precursor composition. In certain embodiments, the material of the reservoir substrate 210 can be absorbent, adsorbent, or otherwise porous so as to provide the ability to retain the aerosol precursor composition. As such, the aerosol precursor composition can be characterized as being coated on, adsorbed by, or absorbed in the material of the reservoir substrate 210. The reservoir substrate 210 can be positioned within the cartridge 200 such that the reservoir substrate is in contact with the
20 liquid transport element 226. More particularly, the reservoir substrate 210 can be manufactured from any material suitable for retaining the aerosol precursor composition (e.g., through absorption, adsorption, or the like) and allowing wicking away of the precursor composition for transport to the heating element 228.

 The material of the reservoir substrate 210 may be suitable for forming and maintaining an
25 appropriate shape. The material of the reservoir substrate 210 can be heat resistant so as to retain its structural integrity and avoid degradation at least at a temperature proximal to the heating temperature provided by the heating element 228. However, the reservoir substrate 210 need not be heat resistant to the full temperature produced by the heating element 228 due to the reservoir substrate being out of contact therewith. The size and strength of the reservoir substrate 210 may
30 vary according to the features and requirements of the cartridge 200. In particular embodiments, the reservoir substrate 210 can be manufactured from a material suitable for a high-speed, automated manufacturing process. Such processes may reduce manufacturing costs compared to traditional woven or non-woven fiber mats. According to one embodiment, the reservoir can be manufactured from a cellulose acetate tow which can be processed to form a hollow acetate tube.

In certain embodiments, the reservoir substrate 210 can be provided in a form such that at least part of the cavity 256 is shaped and dimensioned to accommodate one or more other components of the cartridge 200. In some embodiments, the term “shaped and dimensioned” can indicate that a wall of the reservoir substrate 210 at the cavity 256 includes one or more
5 indentations or protrusions that cause the interior of the reservoir substrate to have a shape that is other than substantially smooth and continuous. In other embodiments, the hollow nature of the reservoir substrate 210 can be sufficient to allow for accommodation of further components of the cartridge 200 without the need for formation of cavities or protrusions. Thus, the cartridge 200 can be particularly beneficial in that the reservoir substrate 210 can be pre-formed and can have a
10 hollow interior defining the cavity 256 with a wall that is shaped and dimensioned to accommodate a further component of the cartridge in a mating arrangement. This particularly can facilitate ease of assembly of the cartridge 200 and can maximize the volume of the reservoir substrate 200 while also providing sufficient space for aerosol formation.

In the illustrated embodiment, the cavity 256 extending through the reservoir substrate 210
15 is shaped and dimensioned to accommodate at least a portion of the atomizer 208. Specifically, the reservoir substrate 210 includes two diametrically opposed grooves 260a, 260b (collectively, “grooves 260”) at the cavity 256. As illustrated, the grooves 260 may extend substantially the entire length of the reservoir substrate 210 from the first end 258a to the second end 258b thereof. In light of the reservoir substrate 210 defining the cavity 256 therethrough, the atomizer 208 can be
20 easily positioned interior to the reservoir substrate during assembly of the smoking article. Likewise, since the cavity 256 is shaped and dimensioned to mate with the atomizer 208, the combination can be easily assembled, and the atomizer can snugly mate with the reservoir substrate 210 while simultaneously placing the liquid transport element 226 in fluid connection with the reservoir substrate.

25 In this regard, the grooves 260 may be configured to receive the liquid transport element 226 at least partially therein. More particularly, the distal arms 240 of the liquid transport element 226 may be received in the grooves 260. Thus, the liquid transport element 226 may extend substantially entirely through the reservoir substrate 210 such that the liquid transport element ends 232 are positioned proximate the first reservoir end 258a. Further, the heater terminals 230 may
30 extend through the cavity 256 through the reservoir substrate 210. In some embodiments the heater terminals 230 may be partially or fully received in the grooves 260. Additionally, the electronic control component 206 may be at least partially received in the cavity 256 through the reservoir substrate 210.

By adapting the cavity 256 of the reservoir substrate 210 to accommodate the atomizer 208, and/or various other components of the cartridge 200, available open space in the cartridge can be fully maximized by extending the reservoir substrate into the previously open spaces. As a result, the overall size and capacity of the reservoir substrate 210 can be increased in comparison to traditional woven or non-woven fiber mats that are typically utilized in electronic smoking articles. The increased capacity allows the reservoir substrate 210 to hold an increased amount of the aerosol precursor composition which may, in turn, result in longer use and enjoyment of the cartridge 200 by the end user.

As illustrated in FIG. 9, the atomizer 208 may extend through the cavity 256 of the reservoir substrate 210 such that the heating element 228 is positioned proximate the second reservoir end 258b. More particularly, the atomizer 208 may extend completely through the cavity 256 such that the heating element 228 is positioned past the second reservoir end 258b. This embodiment may reduce the heat directly applied by the heating element 228 to the reservoir substrate 210 such that the amount of the aerosol precursor composition vaporized by the heating element is controlled in part by the flow of the aerosol precursor composition through the liquid transport element 226 to the heating element. Accordingly, the amount of aerosol precursor composition vaporized may be more precisely controlled. However, in other embodiments, it is not necessary for the atomizer to extend beyond the second reservoir end, and the atomizer can be positioned relative to the reservoir substrate such that the heating element is received within the cavity of the reservoir substrate.

The aerosol precursor composition may comprise a variety of components including, by way of example, glycerin, nicotine, tobacco, tobacco extract, and/or flavorants. Various components that may be included in the aerosol precursor composition are described in U.S. Pat. No. 7,726,320 to Robinson et al., which is incorporated herein by reference. In some embodiments the aerosol precursor composition may additionally include an effervescent material. The effervescence material may be configured to effervesce under certain circumstances such as when combined with another material.

However, in another embodiment the effervescent material may be configured to effervesce (or otherwise produce bubbles) when exposed to heat. In this regard, the effervescent material may be configured to effervesce at a temperature at, or preferably below, a vaporization temperature of the aerosol precursor composition. By effervescing at, or preferably below, a temperature at which the aerosol precursor vaporizes, the air bubbles formed thereby may force the other components of the aerosol precursor composition to the surface of the liquid transport element 226. Accordingly, when current is applied through the heating element 228, the aerosol precursor component may be forced to the exterior of the liquid transport element 226, and then the aerosol precursor component

may be vaporized more readily due to more immediate and direct contact with the heat produced by the heating element. Thus, the amount of electric power required to vaporize the aerosol precursor component may be reduced by employing an effervescent material as described above.

Embodiments of effervescent materials are described, by way of example, in U.S. Pat. App. Pub.

5 No. 2012/0055494 to Hunt et al., which is incorporated herein by reference. Further, the use of effervescent materials is described, for example, in U.S. Pat. No. 4,639,368 to Niazi et al.; U.S. Pat. No. 5,178,878 to Wehling et al.; U.S. Pat. No. 5,223,264 to Wehling et al.; U.S. Pat. No. 6,974,590 to Pather et al.; and U.S. Pat. No. 7,381,667 to Bergquist et al., as well as US Pat. Pub. Nos. 2006/0191548 to Strickland et al.; 2009/0025741 to Crawford et al.; 2010/0018539 to Brinkley et al.; and 2010/0170522 to Sun et al.; and PCT WO 97/06786 to Johnson et al., all of which are
10 incorporated by reference herein.

The reservoir substrate 210 includes an exterior surface 262 that can be substantially shaped and adapted to conform to an interior surface 264 of the external shell 212. In this regard, the external shell 212 may define a tubular shape with a cavity 266 therethrough sized to receive the
15 reservoir substrate 210. For example, an inner radius of the external shell 212 may substantially correspond to, or may be slightly larger than, an outer radius of the reservoir substrate 210. Accordingly, the external shell 212 may be received over the reservoir substrate 210 and coupled to the base 202, as illustrated in FIG. 10. In this regard, one or more indentations 268 may engage the threads or protrusions 224 on the base 202 such that coupling is retained therebetween.

20 As illustrated in FIG. 11, the external shell 212 may couple to the mouthpiece 214 such that the cavity 266 defined by the external shell is at least partially enclosed. More particularly, in one embodiment one or more indentations 270 may engage threads or protrusions 272 on the mouthpiece 214 (see, e.g., FIG. 2) such that coupling therebetween is retained. The mouthpiece 214 defines one or more openings 274 through which air mixed with aerosol produced by the
25 atomizer 208 may be directed when a user draws on the mouthpiece, as described in accordance with the above-noted example embodiments of smoking articles.

FIGS. 12 and 13 illustrate a coupler or receptacle 300 that may be included in a control body configured to engage the cartridge 200 and the various other embodiments of cartridges described below. As illustrated, the receptacle 300 may comprise protrusions or threads 302 that
30 are configured to engage an external shell of the control body such that a mechanical connection is formed therebetween. The receptacle 300 may define an outer surface 304 configured to mate with an internal surface 276 of the base 202. In one embodiment the internal surface 276 of the base 202 may define a radius that is substantially equal to, or slightly greater than, a radius of the outer surface 304 of the receptacle 300. Further, the receptacle 300 may define one or more protrusions

306 at the outer surface 304 configured to engage one or more recesses 278 defined at the inner surface 276 of the base 202. However, various other embodiments of structures, shapes, and components may be employed to couple the base 202 to the receptacle 300. In some embodiments the connection between the base 202 and the receptacle 300 of the control body may be substantially permanent, whereas in other embodiments the connection therebetween may be releasable such that, for example, the control body may be reused with one or more additional cartridges.

The receptacle 300 may further comprise a plurality of electrical contacts 308a-c respectively configured to contact the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230. The electrical contacts 308a may be positioned at differing radial distances from a central opening 310 through the receptacle 300 and positioned at differing depths within the receptacle 300. The depth and radius of each of the electrical contacts 308a-c is configured such that the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230 respectively come into contact therewith when the base 202 and the receptacle 300 are joined together to establish an electrical connection therebetween. More particularly, in the illustrated embodiment, a first electrical contact 308a defines the smallest diameter, a third electrical contact 308c defines the greatest diameter, and a second electrical contact 308b defines a diameter therebetween. Further, the electrical contacts 308a-c are located at differing depths within the receptacle 300 relative to a connector end thereof. In the illustrated embodiment, the first electrical contact 308a is located at a greatest depth, the third electrical contact 308c is located at the smallest depth, and the second electrical contact 308b is located at a depth therebetween. Accordingly, the first electrical contact 308a may be configured to contact the end 220 of the control component terminal 204, the second electrical contact 308b may be configured to contact the second end 248b of the second heater terminal 230b, and the first end 248a of the first heater terminal 230a may be configured to contact the third electrical contact 308c.

In the illustrated embodiment the electrical contacts 308a-c comprise circular metal bands of varying radii positioned at differing depths within the receptacle 300 as described above. In one embodiment the bands may comprise continuous round rings. In another embodiment, the bands may comprise a sheet of metal material that is wound into the circular configuration and defines a joint where the ends thereof meet. In some embodiments the joint between the ends of each band of metal material may be configured at opposing non-perpendicular angles relative to a longitudinal length of the metal material defining the bands. Thereby, the ends of the band may meet at a joint that does not extend parallel to a central axis extending through the receptacle 300. This configuration may be preferable in that it avoids creating a joint extending parallel to the central

axis through the receptacle, which could form a poor connection with an end of one of the heater terminals or the control component terminal when in contact therewith. Each of the bands defines a major contact surface facing radially inwardly toward the central axis of the receptacle 300. The bands defining the electrical contacts 308a-c are separated from one another by stepped surfaces of the body of the receptacle, which may be oriented perpendicularly to the radially facing major surfaces of the electrical contacts.

When the electrical contacts 308a-c comprise circular bands and the end 220 of the control component terminal 204 and the ends 248a, 248b of the heater terminals 230 extend to corresponding depths and radii within the base 202, electrical connections between the base and the receptacle 300 may be established regardless of the rotational orientation of the base with respect to the receptacle. Accordingly, connection between the base 202 of the cartridge 200 and the receptacle 300 of the control body may be facilitated. The electrical contacts 308a-c may be respectively coupled to a plurality of control body terminals 312a-c that connect to a plurality of components within the control body such as a battery and a controller therefor.

Further, when the base 202 of the cartridge 200 and the receptacle 300 of the control body are coupled together, a fluid connection may also be established. In this regard, the receptacle 300 may define a fluid pathway configured to receive air from an ambient environment and direct the air to the cartridge 200 when a user draws thereon. More particularly, in one embodiment the receptacle 300 may define a rim 314 with a radially extending notch 316 defined therein. Further a longitudinally extending recessed slot 318 may extend from the notch 316 to an opening 320. The opening 320 may define a cutout or a hole through a portion of the receptacle in some embodiments. Thus, when the receptacle 300 is engaged with the end of an external shell or body of a corresponding control body, the fluid pathway through the notch 316, the slot 318, and the opening 320 may remain open. Air drawn through this path may then be directed through the central opening 310 of the receptacle 300 and the central opening 254 of the base 202 when the receptacle and the base are connected to one another. Accordingly, air may be directed from the control body through the cartridge 200 in the manner described above when a user draws on the mouthpiece 214 of the cartridge.

Accordingly, the above-described cartridge 200 may provide benefits in terms of ease of assembly and ease of attachment to the receptacle 300 of a control body. In particular, with respect to the cartridge 200, assembly thereof may be simplified in that the components thereof may be axially assembled. More specifically, the components of the cartridge 200 may be assembled in the order illustrated in FIG. 2 in some embodiments. Thus, for example, the control component terminal 204 may be coupled to the base 202, the electronic control component 206 may be coupled

to the control component terminal, the atomizer 208 may be coupled to the base, the reservoir substrate 210 may be coupled to the atomizer, the external shell 212 may be coupled to the base, and the mouthpiece 214 may be coupled to the external shell, in that order. Although this order of assembly may facilitate assembly of the cartridge 200, the components thereof may be assembled in differing orders in other embodiments.

An alternate embodiment of a cartridge 400 for a smoking article is illustrated in FIG. 14. The cartridge 400 may be substantially similar to the above-described embodiment of a cartridge 200 illustrated in FIG. 2. Accordingly, only differences with respect to the above-described embodiment of a cartridge 200 will be highlighted.

In this regard, the cartridge 400 may comprise a base 402, a control component terminal 404, an electronic control component 406, an atomizer 408, a reservoir substrate 410, an external shell 412, and a mouthpiece 414. The cartridge 400 may be configured to couple to a control body to form a smoking article. Accordingly, the cartridge 400 may include embodiments of each of the components described above with respect to the embodiment of the cartridge 200 illustrates in FIG. 2.

However, as illustrated in FIG. 14, the electronic control component 406 may comprise two portions 406a, 406b. A first portion 406a of the electronic control component 406 may include hardware and/or software configured to perform one or more functions, whereas the second portion 406b of the electronic control component may provide structural support thereto. Accordingly, the electronic control component 406 may be provided in two-piece form in some embodiments. This form may allow for substitution of the first portion 406a, as may be desirable to change the functionality of the electronic control component 406, while still employing the same second portion 406b for structural support.

The atomizer 408 may also differ in one or more aspects. In this regard, as illustrated in FIG. 15, the shape of the first heater terminal 430a and the second heater terminal (collectively, "heater terminals 430") may differ in that the first tab 444a and the second tab 444b (collectively, "tabs 444") may be positioned at the end of the heater terminals distal to the base 402 and extend therefrom. In this regard, as illustrated in FIG. 16, the atomizer 408 may comprise a liquid transport element 426 and a heating element 428. The heating element 428 may comprise a wire 434 defining a plurality of coils wound about the liquid transport element 426 and extending between a first wire end 436a and a second wire end 436b (collectively, "wire ends 436"). The tabs 444 may be configured to contact the wire ends 436 such that an electrical connection is established therebetween. In this regard, the tabs 444 may be configured to be positioned adjacent to the heating element 428 such that tabs contact one or more coils of the wire 434.

In one embodiment, as illustrated in FIG. 16, the spacing of the coils (i.e. the distance therebetween) may be less proximate the wire ends 436 than proximate a center of the heating element 428. For example, in one embodiment the coils of the heating element 428 may touch one another at the wire ends 436, whereas the coils may be spaced apart such that there is not contact therebetween between the wire ends. By decreasing the spacing between the coils of the wire 434 at the wire ends 436, more coils may contact the tabs 444, such that an improved electrical connection between the heating element 428 and the heater terminals 430 may be established. Although not illustrated, a weld may optionally be provided to secure the connection between the tabs 444 and the wire ends 436.

As illustrated in FIG. 14, the cartridge 400 may also include a retainer clip 480 in some embodiments. The retainer clip 480 may be configured to surround the atomizer 408 and retain the liquid transport element 426 in contact with the heater terminals 430. More specifically, a first distal arm 440a and a second distal arm 440b (collectively, "distal arms 440") of the liquid transport element 426 may be held in place against the heater terminals 430 by the retainer clip 480. The retainer clip 480 may define a plurality of inwardly extending bendable tabs. In some embodiments, as illustrated, the bendable tabs may include pre-bent tabs 482a, 482b configured to allow the distal arms 440 of the liquid transport element 426 to be received therethrough. After assembly of the cartridge 400, the retainer ring 480 may be positioned between the base 402 and the reservoir substrate 410.

Another difference between the cartridge 200 illustrated in FIG. 2 and the cartridge 400 illustrated in FIG. 14 is that in the embodiment the cartridge 400 illustrated in FIG. 14, the liquid transport element 426 and the heating element 428 may not be coupled to the heater terminals 430 until after the heater terminals are coupled to the base 402. In contrast, in the embodiment of the cartridge 200 illustrated in FIG. 2, the heater terminals 230 may be coupled to the liquid transport element 226 and the heating element 228 prior to coupling the atomizer 208, as an assembled unit, to the base 202. Coupling the assembled atomizer 208 to the base 202 may provide benefits in terms of assembly efficiency, whereas coupling the heater terminals 430 to the base 402 prior to coupling the liquid transport element 426 and the heating element 428 thereto may provide benefits in terms of use of the base as a structural member to hold the heater terminals in place during assembly, which may facilitate production of the heater terminals. Accordingly, both embodiments of assembly methods and related structures may provide benefits.

As illustrated in FIGS. 17-20, in some embodiments the cartridge may additionally include a flow tube 484. In some embodiments the flow tube 484 may comprise a ceramic material. For

example, the flow tube 484 may comprise 96.5% aluminum trioxide in one embodiment. However, the flow tube 484 may be formed from various other materials in other embodiments.

As illustrated in FIG. 17, the flow tube 484 may be positioned between, and held in place by, the terminals 430. More particularly, as illustrated in FIG. 18, the flow tube 484 may define first 486a and second 486b opposing grooves (collectively, "grooves 486"). The grooves 486 may be sized and shaped to respectively receive one of the terminals 430 therein. In this regard, in some embodiments the flow tube 484 may define a generally round outer perimeter, with the exception of the grooves 486. Thus, the flow tube 484 may be received inside the cavity defined through the reservoir substrate 410. Accordingly, the flow tube 484 may additionally or alternatively be held in place by the reservoir substrate 410.

The flow tube 484 may further comprise a cutout 488 configured to receive the top of an electronic control component 406' therein. Optional differences with respect to the electronic control component 406' and the previously described embodiments of electronic control components are described below. By receiving the top of the electronic control component 406' in the cutout 488, the flow tube 484 may be at least partially coupled thereto. In this regard, during assembly of the cartridge, in one embodiment the flow tube 484 may be attached to the electronic control component 406' via reception of the top of the electronic control component in the cutout 488 prior to coupling the atomizer 408 to the base. However, in another embodiment the flow tube 484 may be coupled to the atomizer 408 via reception of the terminals 430 in the grooves 486 such that the cutout 488 engages the electronic control component 406' at the same time that the atomizer is coupled to the base 402.

The flow tube 484 may be configured to direct a flow of air received from a central opening 454 (see, FIG. 14) in the base 402 to the heating element 428 of the atomizer 408. More particularly, as illustrated in FIG. 18, the flow tube 484 may define a through hole 490 configured to receive air from the central opening 454 in the base 402 and direct it to the heating element 428. The electronic control component 406' may substantially align with a center of the through hole 490 such that air directed through the central opening 454 in the base 402 is directed around both sides of the electronic control component and then converges in the through hole 490. However, in other embodiments the central opening 454 in the base 402 may be configured to direct flow to only one side of the electronic component 406'. In this regard, in one embodiment the electronic control component 406' may define a substantially smooth surface on one side, and the flow of air from the central opening 454 in the base 402 may be directed to only the smooth side of the electronic control component. However, various other embodiments of electronic control components may be employed.

In the illustrated embodiment, the flow tube 484 defines a truncated side 492a (see, e.g., FIG. 19) and an elongated side 492b (see, e.g., FIG. 20). The elongated side 492b may define a flow channel 494 (see, e.g., FIG. 18) with a substantially constant area between the flow tube 484 and the electronic control component 406'. In some embodiments the electronic control component 406' may define the substantially smooth surface on the side adjacent to the elongated side 492b of the flow tube 484, as described above. Thus, the flow channel 494 may be substantially free of interference, which may improve flow to the heating element 428.

In contrast, the truncated side 492a of the flow tube 484 may be provided in order to complete the substantially round outer perimeter of the flow tube such that it may be retained in place in the reservoir substrate 410 and provide material through which the through hole 490 is defined. The flow tube 484 may be truncated on this side 492a in order to allow for space for components extending from the electronic control component 406'. However, depending on the particular size and shape of the electronic control component, the tubular reservoir substrate may be elongated on both sides such that the flow tube substantially surrounds the electronic control component and flow channels are defined on both sides thereof.

Regardless of the particular flow patterns around the electronic control component 406', the through hole 490 may receive all of the flow of air directed through the central opening 454 in the base 402. Accordingly, the size of the through hole 490 may be selected to define a desired velocity of air directed to the heating element 428. Accordingly, a desired amount of aerosol may be delivered to the air as it passes the heating element 428. For example, the through hole 490 may taper from a relatively larger diameter to a relatively smaller diameter proximate the heating element 428. However, in other embodiments the through hole 490 may define a substantially constant diameter.

FIG. 21 illustrates an additional embodiment of an atomizer 508. The atomizer 508 may be substantially similar to the embodiments of atomizers 208, 408 described above. Accordingly, features of the atomizer 508 that are substantially similar to the previously described embodiments will not be discussed. However, the heating atomizer 508 may differ in that it may further comprise a first connector ring 584a and a second connector ring 584b (collectively, "connector rings 584"). The connector rings 584 may surround a heating element 528. In this regard, as described above, the heating element 528 may comprise a wire 534 defining a plurality of coils wound about a liquid transport element 526 and extending between a first wire end 536a and a second wire end 536b (collectively, "wire ends 536"). The connector rings 584 may surround the heating element 528 at the wire ends 536.

A first heater terminal 530a and a second heater terminal 530b (collectively, "heater terminals 530") may engage the connector rings 584. Accordingly, an electrical connection may be established therebetween. More particularly, as illustrated in FIG. 22, the connector rings 584 may be coupled to the wire ends 536 prior to coupling the heating element 528 and the liquid transport
5 element 526 to the heater terminals 530. Then, the connector rings 584 may be respectively received in a first clip 586a and a second clip 586b (collectively, "clips 586"), which may retain the connectors therein via interference fit. Accordingly, a relatively secure mechanical and electrical connection may be established between the heating element 528 and the heater terminals 530. In this regard, a weld may not be required to connect the heating element 528 to the heater terminals
10 530. However, a weld may be optionally included in some embodiments.

Note that the above-described atomizers and variations thereof may be employed in a variety of embodiments of cartridges for aerosol delivery devices. In this regard, FIG. 23 illustrates a partially exploded view of an aerosol delivery device 600 including a control body 700, which is illustrated in an assembled configuration, and a cartridge 800, which is illustrated in an exploded
15 configuration. The control body 700 may include various components as described above. For example, the control body 700 may include an outer tube 702 and a receptacle or coupler 704 and an end cap 706 coupled to opposing ends of the outer tube. Various internal components inside the outer tube 702 may include, by way of example, a flow sensor, a control component, and an electrical power source (e.g., a battery), and a light emitting diode (LED) element. However, the
20 control body 700 may include additional or alternative components in other embodiments.

As illustrated, the cartridge 800 may comprise a base shipping plug 802, a base 804, a control component terminal 806, an electronic control component 808, a flow tube 810, an atomizer 812, a reservoir substrate 814, an external shell 816, a label 818, a mouthpiece 820, and a mouthpiece shipping plug 822 according to an example embodiment of the present disclosure.
25 Many of these components are substantially similar to the components of the cartridges described above. Accordingly, only differences with respect to the previously-described embodiments of cartridges will be described below.

In this regard, in one embodiment the electronic control component 808 may comprise a single-piece printed circuit board assembly. The electronic control component 808 may include a
30 ceramic substrate, which may comprise about 96% alumina ceramic in one embodiment. This material is inorganic, non-reactive, non-degrading, and non-porous. Use of such a ceramic material may be preferable in that it may define a robust, dimensionally-stable part without requiring a separate supporting structure. Further, such a ceramic material may allow for adhesion of a coating thereto. For example, a component side of the electronic control component 808 may comprise a

chloro-substituted poly (para-xylylene) commercially available as Parylene C from Specialty Coating Systems, Inc., or any other coating or other sealant/barrier coating configured to protect components of the circuit board from liquid and moisture. The sealant/barrier coating may also provide the electronic control component 808 with a decreased coefficient of friction, which may facilitate an axial assembly process of the cartridge 800.

Further, the mouthpiece shipping plug 822 is configured to engage openings in the mouthpiece 820 prior to use of the cartridge 800 in order to prevent entry of contaminants through the openings in the mouthpiece. Similarly, the base shipping plug 802 is configured to couple to an inner periphery of the base 804 to protect the base from damage or contamination during transport and storage. Further, the label 818 may serve as an exterior member providing the cartridge 800 with identifying information.

FIG. 24 illustrates a perspective view of the cartridge 800 in a partially assembled configuration. More particularly, FIG. 24 illustrates components of the cartridge 800 in a partially assembled configuration corresponding to the configuration illustrated in FIG. 9. Thus, briefly, FIG. 24 illustrates a configuration in which the control component terminal 806 has been coupled to the base 804, the electronic control component 808 has been coupled to the electronic control component terminal, a first heater terminal 834a and a second heater terminal 834b (collectively, "heater terminals 834") has been coupled to the base, the flow tube 810 is received between the heater terminals, a heating element 840 is coupled to a liquid transport element 838, the heating element is coupled to first and second tabs 836a, 836b (collectively, "tabs 836") of the heater terminals to complete the atomizer 812, and the reservoir substrate 814 is received around the atomizer.

The reservoir substrate 814 may define a cavity 852 extending therethrough from a first reservoir end 854a to a second reservoir end 854b (collectively, "reservoir ends 854"), wherein the first reservoir end is positioned proximate the base 804. In this regard, the reservoir substrate 814 may define a hollow tubular configuration. The reservoir substrate 814 can comprise one or more of various materials and can be formed in a variety of different manners. In one embodiment the reservoir substrate 814 can be formed from a plurality of combined layers that can be concentric or overlapping. For example, the reservoir substrate 814 can be a continuous sheet of a material that is rolled such that the ends thereof meet along a joint 856 to form the hollow tubular configuration, or multiple layers of the material may be wrapped thereabout. Thus, the reservoir substrate 814 may conform to the shape of the components received in the cavity 852 such as the atomizer 812.

As illustrated in FIGS. 23 and 24, in some embodiments the heating element 840 may comprise a wire wound about the liquid transport element 838 and extending along substantially the

entirety of the length of the liquid transport element 838. As further illustrated, in one embodiment the heating element 840 may define a variable coil spacing. The spacing of the coils may be the smallest proximate the tabs 836, greatest at the distal ends of the liquid transport element 838, and in between the spacing of the coils at the tabs and the distal ends between the heater terminals 834.

5 By decreasing the spacing between the coils of the heating element 840 proximate the tabs 836, contact therebetween may be improved. For example, a laser may be directed at a back side of the tabs, opposite from the heating element 840, which may weld the heating element to the tabs in order to provide for a connection therebetween. The spacing of the coils of the heating element 840 between the tabs 836 may be selected to define a desired resistance and/or produce a desired
10 amount of heat. Further, the spacing of the coils of the heating element 840 at the distal ends of the liquid transport element 838 may be relatively large in order to decrease material costs associated with production of the heating element.

The cartridge 800 may additionally include the flow tube 810, which may be substantially similar to the above-described flow tube 484. Thus, as illustrated in FIG. 24, the flow tube 810
15 may be positioned between, and held in place by, the terminals 834. More particularly, the flow tube 810 may define first 858a and second 858b opposing grooves (collectively, "grooves 858"). The grooves 858 may be sized and shaped to respectively receive one of the terminals 834 therein. In this regard, in some embodiments the flow tube 810 may define a generally round outer perimeter, with the exception of the grooves 858. Thus, the flow tube 810 may be received inside
20 the cavity 852 defined through the reservoir substrate 814. Accordingly, the flow tube 810 may additionally or alternatively be held in place by the reservoir substrate 814. The flow tube 810 may also be held in place via contact with the electronic control component 808 in some embodiments.

The flow tube 810 may be configured to direct a flow of air received from the base 804 to the heating element 840 of the atomizer 812. More particularly, as illustrated in FIG. 24, the flow
25 tube 810 may define a through hole 860 extending at least partially along the length of the flow tube at a center thereof and configured to receive air from the base 804 and direct it to the heating element 840. Accordingly, the size of the through hole 860 may be selected to define a desired velocity of air directed to the heating element 840. Accordingly, a desired amount of aerosol may be delivered to the air as the air passes the heating element 840. For example, the through hole 860
30 may taper from a relatively larger diameter to a relatively smaller diameter proximate the heating element 840. However, in other embodiments the through hole 860 may define a substantially constant or increasing diameter.

In some embodiments the flow tube 810 may comprise a ceramic material. For example, the flow tube 810 may comprise 96.5% aluminum tri oxide in one embodiment. This material may

provide heat resistance which may be desirable due to proximity to the heating element 840. However, the flow tube 810 may be formed from various other materials in other embodiments.

The reservoir substrate 814 includes an exterior surface 862 that can be substantially shaped and adapted to conform to an interior surface of the external shell 816 (see, FIG. 23). Accordingly, the external shell 816 may be received over the reservoir substrate 814 and coupled to the base 804. In a fully assembled configuration the cartridge may appear substantially similar to the cartridge 200 illustrated in FIG. 11 with the base shipping plug, the mouthpiece shipping plug, and the label coupled thereto.

A method for assembling a cartridge for a smoking article is also provided. As illustrated in FIG. 25, the method may include providing a base defining a connector end configured to engage a control body, an atomizer, and a reservoir substrate configured to hold an aerosol precursor composition and defining a cavity extending therethrough from a first reservoir end to a second reservoir end at operation 900. Further, the method may include connecting the atomizer to the base at operation 902. Additionally, the method may include inserting the atomizer through the cavity through the reservoir substrate at operation 904.

In some embodiments the method may further comprise assembling the atomizer at operation 906. Assembling the atomizer at operation 906 may comprise providing a plurality of heater terminals, a liquid transport element extending between a first liquid transport element end and a second liquid transport element end, and a heating element. Further, assembling the atomizer at operation 906 may include wrapping the heating element at least partially about the liquid transport element and connecting the heating element to the heater terminals such that the heating element extends therebetween and a first distal arm of the liquid transport element and a second distal arm of the liquid transport element extend along the heater terminals. In some embodiments wrapping the heating element at least partially about the liquid transport element may comprise winding a wire about the liquid transport element to define a plurality of coils wound about the liquid transport element extending between a first wire end and a second wire end. Further, winding the wire about the liquid transport element to define the coils may comprise winding the wire such that a spacing of the coils of the wire is less proximate the first wire end and the second wire end.

In some embodiments assembling the atomizer at operation 906 may comprise coupling a plurality of connector rings to the heating element at the first wire end and the second wire end, wherein connecting the heating element to the heater terminals comprises connecting the heater terminals to the connector rings. In some embodiments connecting the heating element to the heater terminals may comprise connecting the heating element to the heater terminals directly.

Further, connecting the atomizer to the base at operation 902 may comprise connecting the heater terminals to the base. Additionally, inserting the atomizer through the cavity at operation 904 may comprise positioning the atomizer such that the heating element is proximate the second reservoir end, the first distal arm and the second distal arm of the liquid transport element and the heater terminals are at least partially received in the cavity, the first liquid transport element end and the second liquid transport element end are proximate the first reservoir end, and the first reservoir end of the reservoir substrate is proximate the base. Inserting the atomizer through the cavity at operation 904 may further comprise inserting the first distal arm and the second distal arm of the liquid transport element in a plurality of grooves extending between the first reservoir end and the second reservoir end of the reservoir substrate at the cavity.

The method may further comprise providing an electronic control component and a control component terminal at operation 908, connecting the control component terminal to the base at operation 910, coupling the electronic control component to the control component terminal at operation 912, and inserting the electronic control component into the cavity of the reservoir substrate at operation 914. Connecting the control component terminal to the base at operation 910 and connecting the heater terminals to the base may comprise inserting the control component terminal and the heater terminals to a plurality of different heights within the base. Further, connecting the control component terminal to the base at operation 910 and coupling the electronic control component to the control component terminal at operation 912 may be conducted before connecting the heater terminals to the base. The method may further comprise inserting the atomizer through a retainer clip configured to retain the liquid transport element in contact with the heater terminals at operation 916. Additionally, the method may include providing an external shell and a mouthpiece at operation 918 and coupling the external shell to the base and coupling the mouthpiece to the external shell at operation 920.

In some embodiments the method described above and various other embodiments of methods for assembling a cartridge for a smoking article may be substantially automated. For example, an assembly line may employ a plurality of substations to automatically assemble the cartridge. A first substation may provide the base. A second substation may insert the control component terminal into the base. A third substation may insert the heater terminals into the base. A fourth substation may couple the electronic control component to the control component terminal. A fifth substation may attach the flow tube to the electronic control component and the heater terminals. A sixth substation may cut the heating element and the liquid transport element and laser weld the heating element to the heater terminals. A seventh substation may bend the distal arms of the liquid transport element into contact with the heater terminals. An eighth

substation may electrically test the atomizer to determine whether it defines a desired resistance. A ninth substation may flow test the assembly to determine if it defines a desired pressure drop. A tenth substation may couple the reservoir substrate to the assembly and couple a sleeve around the reservoir substrate. An eleventh substation may couple the sleeve to the base, for example by
5 crimping the sleeve thereon. A twelfth substation may flow test the assembly to determine if it defines a desired pressure drop. A thirteenth substation may couple a shipping plug to the base to protect the base during shipment.

Thereafter, the assembly created by the above-described substations may be transported to a second assembly line. The second assembly line may include a first substation that brings a
10 mouthpiece into contact with the sleeve. A second substation may press the mouthpiece into the sleeve. A third substation may crimp the sleeve to retain the mouthpiece in place. A fourth substation may laser mark the sleeve and visually inspect the assembly. A fifth substation may wrap a label around the assembly and visually inspect the assembly to determine if the label is properly positioned. A sixth substation may insert a shipping plug into the mouthpiece. A seventh
15 substation may off-load the completed assemblies and separate out rejects. However, it should be understood that the above-described operations may be performed in other manners by other combinations of substations, in other orders, and/or with a greater or smaller number of assembly lines.

In the various embodiments described above, the heating element is generally described as
20 comprising a wire wound about a liquid transport element and defining a plurality of coils thereon. However, various other embodiments of heating elements may be employed. In this regard, various other embodiments of heating elements and methods and inputs for the production thereof are provided below.

By way of example, FIG. 26 illustrates an input 1000 for production of a plurality of
25 atomizers. As illustrated, the input 1000 may comprise a carrier 1002 defining a plurality of access windows 1004 spaced apart along a longitudinal axis 1006 of the carrier. The input 1000 may further comprise a plurality of heating elements 1008 that are coupled to the carrier 1002 and respectively received in the access windows 1004.

In some embodiments the carrier 1002 and the heating elements 1008 may be integrally
30 formed from a sheet of a material. The material defining the sheet may comprise a material configured to produce heat when an electrical current is applied thereto. For example, the material may comprise Kanthal (FeCrAl), Nichrome, Molybdenum disilicide (MoSi_2), molybdenum silicide (MoSi), Molybdenum disilicide doped with Aluminum ($\text{Mo}(\text{Si},\text{Al})_2$), or ceramic (e.g., a positive

temperature coefficient ceramic). However, various other materials may be employed in other embodiments.

Various embodiments of operations may be performed to produce the input 1000. For example, the sheet of the material may be cut (e.g., die or laser cut), stamped, and/or various other operations may be performed thereon. Accordingly, the input 1000 may be produced in a relatively simple manner, which may be repeated on a large scale to produce a number of the inputs, or a continuous roll of the input.

As further illustrated in FIG. 26, the carrier 1002 may comprise a first side strip 1010a and a second side strip 1010b (collectively, "side strips 1010") extending parallel to the longitudinal axis 1006 of the carrier 1002. The side strips 1010 may be employed to impart motion to the input 1000 along the longitudinal axis 1006 of the carrier 1002 during use thereof to produce atomizers. For example, pairs of counter-rotating wheels may engage the side strips 1010. In another embodiment one or both of the side strips 1010 may include a plurality of apertures 1012 extending therethrough. Thus, by way of example, the apertures 1012 may be engaged by protrusions on rotating wheels in order to impart motion to the input 1000 along the longitudinal axis 1006 of the carrier 1002.

In some embodiments the carrier 1002 may further comprise a plurality of connecting strips 1014 extending between the first side strip 1010a and the second side strip 1010b and separating the access windows 1004. For example, in the illustrated embodiment the connecting strips 1014 are configured perpendicularly to the side strips 1010. The connecting strips 1014 may provide the input 1000 with support and stability. As illustrated in FIG. 26, in some embodiments a first end 1016 and a second end 1018 of each of the heating elements 1008 may be respectively coupled to one of the connecting strips 1014. Thus, connections between the ends 1016, 1018 of the heating elements 1008 and the connecting strips 1014 may be retained when the input 1000 is formed from the sheet of the material. Accordingly, in one embodiment the heating elements 1008 may be directly supported by the connecting strips 1014 and indirectly supported by the side strips 1010, to which the connecting strips couple. In this embodiment, longitudinal axes 1020 of each of the heating elements 1008 may be coaxial with the longitudinal axis 1006 of the carrier 1002.

FIG. 27 illustrates an enlarged view of one of the heating elements 1008 with the remainder of the input 1000 not shown for clarity purposes. Note that the heating element 1008 may be produced without first being formed as a part of the input 1000. In this regard, the heating elements 1008 may still be produced from a sheet of a material, but the heating elements may be separated from one another or provided in differing connected forms in some embodiments of the present disclosure.

The heating element 1008 may comprise the first end 1016, the second end 1018, and a plurality of interconnected loops 1022 connected to the first end and the second end through a first connector section 1023a and a second connector section 1023b (collectively, "connector sections 1023"). The connector sections 1023 may couple the ends 1016, 1018 to the loops 1022. As
5 illustrated in FIG. 27, in some embodiments the loops 1022 may be oriented transversely to the longitudinal axis 1020 of the heating element 1008 and the connector sections 1023. In other words, the loops 1022 may generally extend perpendicularly relative to the longitudinal axis 1020 of the heating element 1008 and the connector sections 1023.

As further illustrated in FIG. 27, the loops 1022 may be alternately disposed with respect
10 to the longitudinal axis 1020 and the connector sections 1023. In this regard, as illustrated in FIG. 27, a first loop 1022a may be positioned on a first side 1024 of the longitudinal axis 1020 and the connector sections 1023, and a second loop 1022b may be positioned on an opposing second side 1026 of the longitudinal axis and the connector sections. This pattern may be repeated for one or more additional loops 1022.

As noted above, the input 1000 as a whole, including the heating elements 1008 may be
15 formed from a single sheet of a material. In this regard, the first end 1016, the second end 1018, the connector sections 1023, and the interconnected loops 1022 may be integrally formed from the sheet of the material. As noted above, various embodiments of materials may be employed. For example, the sheet may comprise Kanthal (FeCrAl), Nichrome, Molybdenum disilicide (MoSi_2),
20 molybdenum silicide (MoSi), Molybdenum disilicide doped with Aluminum ($\text{Mo}(\text{Si},\text{Al})_2$), and ceramic (e.g., a positive temperature coefficient ceramic). In this regard, the material may be configured to produce heat when electrical current is applied therethrough. Further, in some embodiments the material may be configured to bend, as described below. In some embodiments the material of the sheet may be a metal material.

In some embodiments the first end 1016 and the second end 1018 of the heating element
25 1008 may define a width 1028 that is greater than a width 1030 of the material defining the interconnected loops 1022 and the connector sections 1023. Providing the first end 1016 and the second end 1018 of the heating elements 1008 with a greater width 1028 than the width 1030 of the material defining the interconnected loops 1022 and the connecting sections 1023 may provide the
30 first end and the second end with a relatively larger surface area that may facilitate connection of the heating elements to heater terminals. For example, welding and/or other methods of coupling the heating elements 1008 to the heater terminals may be employed, as described elsewhere herein.

The heating elements 1008 may be at least partially bent around a liquid transport element in order to form an atomizer. In some embodiments the heating elements 1008 may be pre-bent

prior to coupling to a liquid transport element such that they me received partially about the liquid transport element prior to completion of bending thereabout. In this regard, FIG. 26 illustrates a first portion 1034 of the heating elements 1008 in an initial planar configuration and a second portion 1036 of the heating elements are illustrated as having been pre-bent from the initial planar configuration to an intermediate, pre-bent configuration. In the intermediate configuration, at least a part of the interconnected loops 1022 may be oriented in a non-planar configuration relative to a remainder of the input 1000. For example, at least a portion of the interconnected loops 1022 may be oriented substantially perpendicular to a plane defined by the remainder of the input 1000 such that the interconnected loops oppose one another. Accordingly, the pre-bent heating elements 1008 may receive a liquid transport element between the opposing interconnected loops 1022. However, in other embodiments the heating elements 1008 may be wrapped about the liquid transport element without first pre-bending the interconnected loops. For example, the heating elements 1008 may be bent from the planar configuration to a configuration in which the interconnected loops 1022 at least partially wrap about the liquid transport element without first being bent to an intermediate configuration.

Regardless of whether the interconnected loops 1022 are pre-bent to the intermediate configuration, the interconnected loops may ultimately be wrapped at least partially around a liquid transport element. By way of example, FIG. 28 illustrates one of the heating elements 1008 in a fully bent configuration. Note that in the fully bent configuration, the heating elements 1008 may be wrapped around a liquid transport element. However, the liquid transport element is not shown in FIG. 28 for clarity purposes.

As illustrated in FIG. 28, the interconnected loops 1020 may be bent such that a plurality of tips 1038 of the interconnected loops are positioned adjacent one another. Further, the interconnected loops 1022 may define a substantially cylindrical void 1040 extending parallel to the longitudinal axis 1020 of the heating element 1008 and the connector sections 1023. The substantially cylindrical void 1040 may be configured to define a radius substantially equal to a radius of the liquid transport element about which the interconnected loops 1022 are wrapped, such that the heating element 1008 may be retained thereon. Note that in the bent configuration, the connector sections 1023 and the ends 1016, 1018 may remain in a substantially planar configuration.

A second embodiment of an input 1100 for production of a plurality of atomizers is illustrated in FIG. 29. As illustrated, the input 1100 illustrated in FIG. 29 may be substantially similar to the input 1000 illustrated in FIG. 26. Accordingly, similar features of the input 1100 will not be described in detail, and only differences therebetween will be highlighted.

In this regard, as illustrated in FIG. 29, the input 1100 may comprise a carrier 1102 defining a plurality of access windows 1104 spaced apart along a longitudinal axis 1106 of the carrier. The input 1100 may further comprise a plurality of heating elements 1108 that are coupled to the carrier 1102 and respectively received in the access windows 1104. The carrier 1102 may comprise a first side strip 1110a and a second side strip 1110b (collectively, "side strips 1110") extending parallel to the longitudinal axis 1106. The side strips 1110 may include a plurality of apertures 1112 extending therethrough.

The carrier 1102 may further comprise a plurality of connecting strips 1114 extending between the first side strip 1110a and the second side strip 1110b (e.g., perpendicularly thereto) and separating the access windows 1104. In the embodiment of the input 1000 described above and illustrated in FIG. 26, the ends 1016, 1018 of each of the heating elements 1008 are respectively coupled to one of the connecting strips 1014. In contrast, in the embodiment of the input 1100 illustrated in FIG. 29, a first end 1116 and a second end 1118 of each of the heating elements 1108 are respectively coupled to one of the first side strip 1110a and the second side strip 1110b. Thus, the heating elements 1108 may be directly coupled to and supported by the side strips 1110 in some embodiments. In this embodiment, connections between the ends 1116, 1118 of the heating elements 1108 and the side strips 1110 may be retained when the input 1100 is formed.

Further, a plurality of longitudinal axes 1120 of the heating elements 1108 may be perpendicular to the longitudinal axis 1106 of the carrier 1102. Each of the longitudinal axes 1120 of the heating elements 1108 may be parallel with one another in some embodiments. A plurality of interconnected loops 1122 may be respectively connected to the first end 1116 and the second end 1118 by a first connector section 1123a and a second connector section 1123b (collectively, "connector sections 1123"). The interconnected loops 1122 may be oriented transversely to the longitudinal axes 1120 of the heating elements 1108 and the connector sections 1123 and alternately disposed with respect thereto.

A first portion 1134 of the input 1100 is illustrated with the interconnected loops 1122 of the heating elements 1108 in an unbent, planar configuration. In contrast, a second portion 1136 of the input 1100 is illustrated with the interconnected loops 1122 in a pre-bent configuration. As described above, the input 1100 may be provided in either the planar or pre-bent configurations prior to being wrapped about a liquid transport element.

FIG. 30 illustrates production of atomizers according to an example embodiment of the present disclosure. In the illustrated embodiment, by way of example, a cartridge subassembly 1200' comprising a base 1202 with an electronic control component 1206 and first and second heater terminals 1230a, 1230b (collectively, "heater terminals 1230") coupled thereto is provided.

The electronic control component 1206 may be coupled to the base 1202 via a control component terminal 1204.

5 A liquid transport element 1226 may also be provided. In some embodiments the liquid transport element 1226 may be at least partially engaged with the heater terminals 1206 prior to coupling the heating element 1108 thereto. In this regard, FIG. 30 illustrates a cartridge subassembly 1200'' comprising the components of the cartridge subassembly 1200' in addition to the liquid transport element 1226. As illustrated, a first distal arm 1240a and a second distal arm 1240b (collectively, "distal arms 1240") of the liquid transport element 1226 may be engaged with the heater terminals 1230 and a center section 1240c of the liquid transport element may extend therebetween. Accordingly, the liquid transport element 1226 may be transported to one or more assembly stations by moving the base 1202. Alternatively or additionally, the base 1202 may be employed to hold the liquid transport element 1226 in a position that assists in attachment of one of the heating elements 1108 thereto.

The cartridge subassembly 1200'' may then be moved into proximity with the input 1100. More particularly, one of the heating elements 1108 may be brought into proximity with the center section 1240c of the liquid transport element 1226. Thereby, the interconnected loops 1122 of the heating element 1108 may be at least partially wrapped around the liquid transport element 1226. For example, a pair of actuators may extend into one of the access windows 1104 and compress the interconnected loops 1122 against the liquid transport element 1226. In some embodiments the actuators may define a profile configured to match a profile of the liquid transport element 1226. For example, the actuators may define actuating surfaces configured to engage the heating element 1108 that define a radius substantially equal to a radius of the liquid transport element 1226. However, the liquid transport may define cross-sectional shapes other than rounded in other embodiments, and the actuators configured to bend the heating element may be appropriately configured to match the particular cross-sectional shape. During the bending operation of the heating element 1108 about the liquid transport element 1226, the ends 1116, 1118 of the heating element may remain connected to the carrier 1102. Accordingly, the heating element 1108 may be supported by the carrier 1102 during the bending operation such that issues with respect to retaining the heating element in the proper position may be averted.

30 Thereafter, the ends 1116, 1118 of the heating element 1108 may be decoupled from the carrier 1102 and the ends of the heating element may be connected to the heater terminals 1230 to form an atomizer 1208, as illustrated at cartridge subassembly 1200'''. Additional cartridge subassemblies 1200''' with atomizers 1208 may be produced by repeating the procedures noted above and incrementing the position of the input 1100 such that the next heating element 1108 may

be provided in an appropriate position. For example, in the embodiment illustrated in FIG. 30, the input 1100 may be incremented generally into the page and to the left.

Accordingly, use of the above-described embodiments of heating elements formed from a sheet of a material may be beneficial in that it may eliminate the need to conduct winding

5 operations in which a wire is wound about a liquid transport element. In this regard, winding a wire about a liquid transport element to form a heating element may require a relatively high degree of precision. Further, handling of the wire, which may define a relatively small diameter, may be difficult. In contrast, the formation of heating elements from a sheet of material may only involve relatively simple cutting operations, which may allow for repeatable mass production thereof.

10 Further, the attachment of the heating elements to the liquid transport element may be simplified by employing the carrier to hold the heating elements. Thus, the heating elements may be easily transported to a desired position by moving the carrier. Further, the carrier may support the heating element during attachment to the liquid transport element. Accordingly, use of heating elements formed from a sheet of a material may simplify production of cartridges for a smoking article.

15 A method of forming a plurality of atomizers is also provided. As illustrated in FIG. 30, the method may comprise providing a sheet of a material at operation 1300. The method may further include forming the sheet of the material into a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier at operation 1302. Additionally, the method may include forming the sheet of the material into a plurality of heating elements that are coupled
20 to the carrier and respectively received in the access windows at operation 1304.

In some embodiments the method may further comprise providing a liquid transport element at operation 1306. The method may additionally include bending the interconnected loops about the liquid transport element at operation 1308. A plurality of tips of the interconnected loops may be positioned adjacent one another and the interconnected loops may define a substantially
25 cylindrical void extending parallel to the longitudinal axis of the carrier in which the liquid transport element is received in some embodiments. The method may additionally include decoupling the heating elements from the carrier at operation 1310 and connecting a first end and a second end of each of the heating elements to a plurality of heater terminals at operation 1312.

In some embodiments of the method, forming the sheet of the material into the carrier at
30 operation 1302 may comprise forming a first side strip and a second side strip extending parallel to the longitudinal axis. Further, forming the sheet of the material into the carrier at operation 1302 and forming the sheet of the material into the heating elements at operation 1304 may comprise retaining a plurality of connections between a first end and a second end of the heating elements and the first side strip and the second side strip. Additionally, forming the sheet of the material into

the carrier at operation 1302 may comprise forming a plurality of apertures extending through at least one of the first side strip and the second side strip.

5 In some embodiments of the method, forming the sheet of the material into the carrier at operation 1302 may comprise forming a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows. Further, forming the sheet of the material into the carrier at operation 1302 and forming the sheet of the material into the heating elements at operation 1304 may comprise retaining a plurality of connections between a first end and a second end of each of the heating elements and the connecting strips. Additionally, forming the sheet of the material into the heating elements at operation 1304 may comprise forming
10 a plurality of interconnected loops oriented transversely to a plurality of longitudinal axes of the heating elements. Forming the sheet of the material into the heating elements at operation 1304 may also comprise forming the heating elements such that the longitudinal axes thereof are coaxial with the longitudinal axis of the carrier. In another embodiment, forming the sheet of the material into the heating elements at operation 1304 may comprise forming the heating elements such that
15 the longitudinal axes thereof are perpendicular to the longitudinal axis of the carrier.

In an additional aspect, a controller configured to execute computer code for performing the above-described operations is provided. The controller may comprise a processor that may be a microprocessor or a controller for controlling the overall operation thereof. In one embodiment the processor may be particularly configured to perform the functions described herein. The controller
20 may also include a memory device. The memory device may include non-transitory and tangible memory that may be, for example, volatile and/or non-volatile memory. The memory device may be configured to store information, data, files, applications, instructions or the like. For example, the memory device could be configured to buffer input data for processing by the processor. Additionally or alternatively, the memory device may be configured to store instructions for
25 execution by the processor.

The controller may also include a user interface that allows a user to interact therewith. For example, the user interface can take a variety of forms, such as a button, keypad, dial, touch screen, audio input interface, visual/image capture input interface, input in the form of sensor data, etc. Still further, the user interface may be configured to output information to the user through a
30 display, speaker, or other output device. A communication interface may provide for transmitting and receiving data through, for example, a wired or wireless network such as a local area network (LAN), a metropolitan area network (MAN), and/or a wide area network (WAN), for example, the Internet.

The controller may also include atomizer forming module. The processor may be embodied as, include or otherwise control the atomizer forming module. The atomizer forming module may be configured for controlling or executing the atomizer forming operations described herein.

The various aspects, embodiments, implementations or features of the described
5 embodiments can be used separately or in any combination. Various aspects of the described
embodiments can be implemented by software, hardware or a combination of hardware and
software. The described embodiments can also be embodied as computer readable code on a
computer readable medium for controlling atomizer forming operations. In this regard, a computer
readable storage medium, as used herein, refers to a non-transitory, physical storage medium (e.g.,
10 a volatile or non-volatile memory device, which can be read by a computer system. Examples of
the computer readable medium include read-only memory, random-access memory, CD-ROMs,
DVDs, magnetic tape, and optical data storage devices. The computer readable medium can also
be distributed over network-coupled computer systems so that the computer readable code is stored
and executed in a distributed fashion.

15 Thus, an embodiment of a non-transitory computer readable medium for storing computer
instructions executed by a processor in a controller for an apparatus configured to form atomizers is
provided. The non-transitory computer readable medium may comprise computer code for
providing a sheet of a material, computer code for forming the sheet of the material into a carrier
defining a plurality of access windows spaced apart along a longitudinal axis of the carrier, and
20 computer code for forming the sheet of the material into a plurality of heating elements that are
coupled to the carrier and respectively received in the access windows.

In some embodiments the non-transitory computer readable medium may further comprise
computer code for providing a liquid transport element and computer code for bending the
interconnected loops about the liquid transport element such that a plurality of tips of the
25 interconnected loops are positioned adjacent one another and the interconnected loops define a
substantially cylindrical void extending parallel to the longitudinal axis of the carrier. The non-
transitory computer readable medium may further comprise computer code for decoupling the
heating elements from the carrier and computer code for connecting a first end and a second end of
each of the heating elements to a plurality of heater terminals.

30 Additionally, in some embodiments the computer code for forming the sheet of the material
into the carrier may comprise computer code for forming a first side strip and a second side strip
extending parallel to the longitudinal axis. Computer code for forming the sheet of the material
into the carrier and computer code for forming the sheet of the material into the heating elements
may comprise computer code for retaining a plurality of connections between a first end and a

second end of the heating elements and the first side strip and the second side strip. Computer code for forming the sheet of the material into the carrier may comprise computer code for forming a plurality of apertures extending through at least one of the first side strip and the second side strip. Computer code for forming the sheet of the material into the carrier may comprise computer code
5 for forming a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows.

In some embodiments computer code for forming the sheet of the material into the carrier and computer code for forming the sheet of the material into the heating elements may comprise computer code for retaining a plurality of connections between a first end and a second end of each
10 of the heating elements and the connecting strips. Computer code for forming the sheet of the material into the heating elements may comprise computer code for forming a plurality of interconnected loops oriented transversely to a plurality of longitudinal axes of the heating elements. Computer code for forming the sheet of the material into the heating elements may comprise computer code for forming the heating elements such that the longitudinal axes thereof
15 are coaxial with the longitudinal axis of the carrier. Computer code for forming the sheet of the material into the heating elements may comprise computer code for forming the heating elements such that the longitudinal axes thereof are perpendicular to the longitudinal axis of the carrier.

Many modifications and other embodiments of the disclosure will come to mind to one skilled in the art to which this disclosure pertains having the benefit of the teachings presented in
20 the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the disclosure is not to be limited to the specific embodiments disclosed herein and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS:

1. A cartridge for an aerosol delivery device, the cartridge comprising:
a base defining a connector end configured to engage a control body;
a reservoir substrate configured to hold an aerosol precursor composition, the reservoir
substrate defining a cavity extending therethrough from a first reservoir end to a second reservoir
5 end, wherein the first reservoir end is positioned proximate the base; and
an atomizer comprising a liquid transport element extending between a first liquid transport
element end and a second liquid transport element end and a heating element extending at least
partially about the liquid transport element at a position between the first liquid transport element
end and the second liquid transport element end, the atomizer extending through the cavity of the
10 reservoir substrate such that the heating element is positioned proximate the second reservoir end
and the first liquid transport element end and the second liquid transport element end are positioned
proximate the first reservoir end.
2. The cartridge of Claim 1, wherein the atomizer further comprises a plurality of
15 heater terminals connected to the base and the heating element.
3. The cartridge of Claim 2, wherein the reservoir substrate defines a plurality of
grooves at the cavity extending between the first reservoir end and the second reservoir end and
configured to receive the liquid transport element,
20 wherein the heater terminals extend through the reservoir substrate, or
wherein the heating element comprises a wire defining a plurality of coils wound about the
liquid transport element extending between a first wire end and a second wire end.
4. The cartridge of Claim 3, wherein the atomizer further comprises a plurality of
25 connector rings surrounding the heating element at the first wire end and the second wire end,
wherein the heater terminals engage the connector rings, or
wherein the heater terminals directly contact the wire proximate the first wire end and the
second wire end and a spacing of the coils of the wire is less proximate the first wire end and the
second wire end.
30
5. The cartridge of Claim 2, further comprising a retainer clip surrounding the atomizer
and configured to retain the liquid transport element in contact with the heater terminals,

further comprising an electronic control component and a control component terminal coupled thereto, wherein the electronic control component is received in the cavity of the reservoir substrate and the control component terminal is connected to the base, or
further comprising a mouthpiece and an external shell.

5

6. The cartridge of Claim 5, wherein the control component terminal and the heater terminals extend to a plurality of different depths within the base.

7. A method for assembling a cartridge for an aerosol delivery device, the method comprising:
providing a base defining a connector end configured to engage a control body, an atomizer, and a reservoir substrate configured to hold an aerosol precursor composition and defining a cavity extending therethrough from a first reservoir end to a second reservoir end;
connecting the atomizer to the base; and
inserting the atomizer through the cavity through the reservoir substrate.

10
15

8. The method of Claim 7, further comprising assembling the atomizer, wherein assembling the atomizer comprises:

providing a plurality of heater terminals, a liquid transport element extending between a first liquid transport element end and a second liquid transport element end, and a heating element; wrapping the heating element at least partially about the liquid transport element; and connecting the heating element to the heater terminals such that the heating element extends therebetween and a first distal arm of the liquid transport element and a second distal arm of the liquid transport element extend along the heater terminals.

20
25

9. The method of Claim 8, wherein connecting the atomizer to the base comprises connecting the heater terminals to the base, and

wherein inserting the atomizer through the cavity comprises positioning the atomizer such that the heating element is proximate the second reservoir end, the first distal arm and the second distal arm of the liquid transport element and the heater terminals are at least partially received in the cavity, the first liquid transport element end and the second liquid transport element end are proximate the first reservoir end, and the first reservoir end of the reservoir substrate is proximate the base.

30

10. The method of Claim 9, wherein inserting the atomizer through the cavity further comprises inserting the first distal arm and the second distal arm of the liquid transport element in a plurality of grooves extending between the first reservoir end and the second reservoir end of the reservoir substrate at the cavity, or

5 wherein wrapping the heating element at least partially about the liquid transport element comprises winding a wire about the liquid transport element to define a plurality of coils wound about the liquid transport element extending between a first wire end and a second wire end.

11. The method of Claim 10, wherein connecting the heating element to the heater
10 terminals comprises coupling a plurality of connector rings to the heating element at the first wire end and the second wire end and connecting the heater terminals to the connector rings,

wherein connecting the heating element to the heater terminals comprises connecting the heating element to the heater terminals directly, or

wherein winding the wire about the liquid transport element to define the coils comprises
15 winding the wire such that a spacing of the coils of the wire is less proximate the first wire end and the second wire end.

12. The method of Claim 9, further comprising inserting the atomizer through a retainer clip configured to retain the liquid transport element in contact with the heater terminals,

20 further comprising:

providing an electronic control component and a control component terminal;
connecting the control component terminal to the base;
coupling the electronic control component to the control component terminal; and
inserting the electronic control component into the cavity of the reservoir substrate;

25 or

further comprising:

providing an external shell and a mouthpiece; and
coupling the external shell to the base and coupling the mouthpiece to the external

shell.

30

13. The method of Claim 12, wherein connecting the control component terminal to the base and connecting the heater terminals to the base comprise inserting the control component terminal and the heater terminals to a plurality of different heights within the base, or

wherein connecting the control component terminal to the base and coupling the electronic control component to the control component terminal are conducted before connecting the heater terminals to the base.

- 5 14. An input for production of a plurality of atomizers, the input comprising:
a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier; and
a plurality of heating elements that are coupled to the carrier and respectively received in the access windows,
10 wherein the carrier and the heating elements are integrally formed from a sheet of a material.

- 15 15. The input for production of atomizers of Claim 14, wherein the carrier comprises a first side strip and a second side strip extending parallel to the longitudinal axis.

- 16 16. The input for production of atomizers of Claim 15, wherein a first end and a second end of each of the heating elements are respectively coupled to one of the first side strip and the second side strip,
wherein at least one of the first side strip and the second side strip defines a plurality of
20 apertures extending therethrough, or

- wherein the carrier further comprises a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows, a first end and a second end of each of the heating elements being respectively coupled to one of the connecting strips.

- 25 17. The input for production of atomizers of Claim 14, wherein the heating elements define a plurality of longitudinal axes and each of the heating elements comprises a plurality of interconnected loops oriented transversely to the longitudinal axes and alternatingly disposed with respect thereto.

- 30 18. The input for production of atomizers of Claim 17, wherein the longitudinal axes of the heating elements are coaxial with the longitudinal axis of the carrier, or
wherein the longitudinal axes of the heating elements are perpendicular to the longitudinal axis of the carrier.

19. A heating element, comprising:
a first end;
a second end; and
5 a plurality of interconnected loops coupled to the first end and the second end, the interconnected loops being oriented transversely to a longitudinal axis extending between the first end and the second end and alternatingly disposed with respect thereto,
wherein the first end, the second end, and the plurality of interconnected loops are integrally formed from a sheet of a material.

10

20. The heating element of Claim 19, wherein the interconnected loops are bent toward one another, or
wherein the first end and the second end define a width that is greater than a width of the material defining the interconnected loops.

15

21. The heating element of Claim 20, wherein a plurality of tips of the interconnected loops are positioned adjacent one another and the interconnected loops define a substantially cylindrical void extending parallel to the longitudinal axis.

20

22. A method of forming a plurality of atomizers, comprising:
providing a sheet of a material;
forming the sheet of the material into a carrier defining a plurality of access windows spaced apart along a longitudinal axis of the carrier; and
forming the sheet of the material into a plurality of heating elements that are coupled to the
25 carrier and respectively received in the access windows.

23. The method of Claim 22, wherein forming the sheet of the material into the carrier comprises forming a first side strip and a second side strip extending parallel to the longitudinal axis.

30

24. The method of Claim 23, wherein forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements comprises retaining a plurality of connections between a first end and a second end of the heating elements and the first side strip and the second side strip,

wherein forming the sheet of the material into the carrier comprises forming a plurality of apertures extending through at least one of the first side strip and the second side strip, or

wherein forming the sheet of the material into the carrier comprises forming a plurality of connecting strips extending between the first side strip and the second side strip and separating the access windows.

25. The method of Claim 24, wherein forming the sheet of the material into the carrier and forming the sheet of the material into the heating elements comprises retaining a plurality of connections between a first end and a second end of each of the heating elements and the connecting strips.

26. The method of Claim 22, wherein forming the sheet of the material into the heating elements comprises forming a plurality of interconnected loops oriented transversely to a plurality of longitudinal axes of the heating elements.

27. The method of Claim 26, wherein forming the sheet of the material into the heating elements comprises forming the heating elements such that the longitudinal axes thereof are coaxial with the longitudinal axis of the carrier, or

wherein forming the sheet of the material into the heating elements comprises forming the heating elements such that the longitudinal axes thereof are perpendicular to the longitudinal axis of the carrier.

28. The method of Claim 26, further comprising providing a liquid transport element; and

bending the interconnected loops about the liquid transport element such that a plurality of tips of the interconnected loops are positioned adjacent one another and the interconnected loops define a substantially cylindrical void extending parallel to the longitudinal axis of the carrier in which the liquid transport element is received.

29. The method of Claim 28, further comprising decoupling the heating elements from the carrier; and

connecting a first end and a second end of each of the heating elements to a plurality of heater terminals.

ABSTRACT

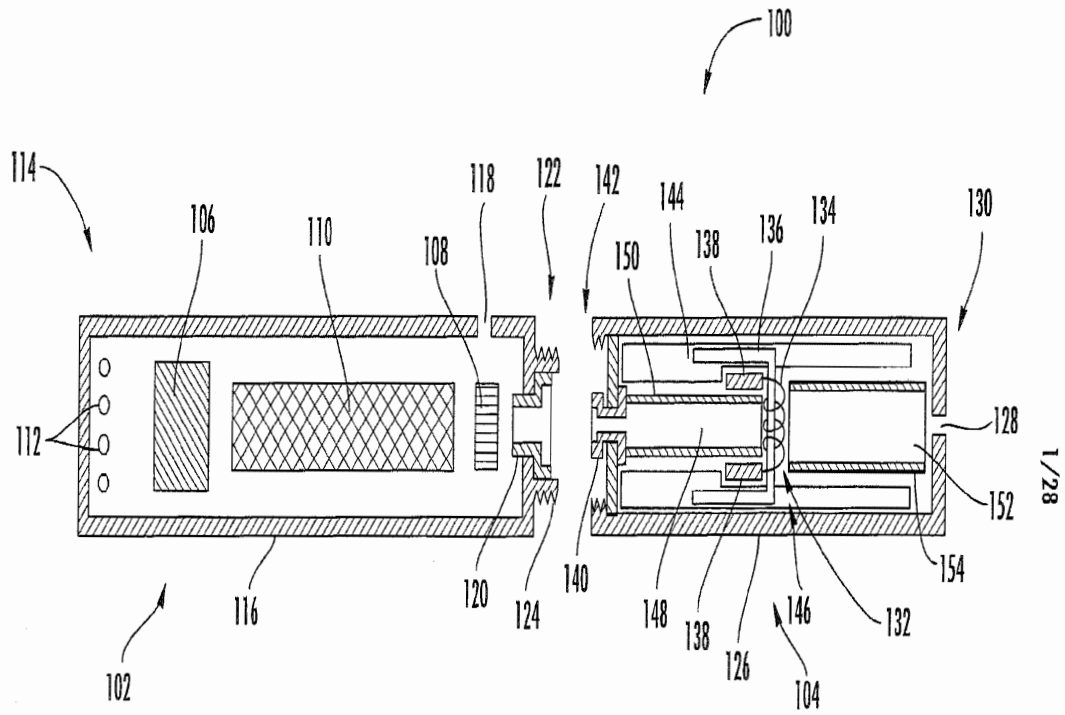


FIG. 1

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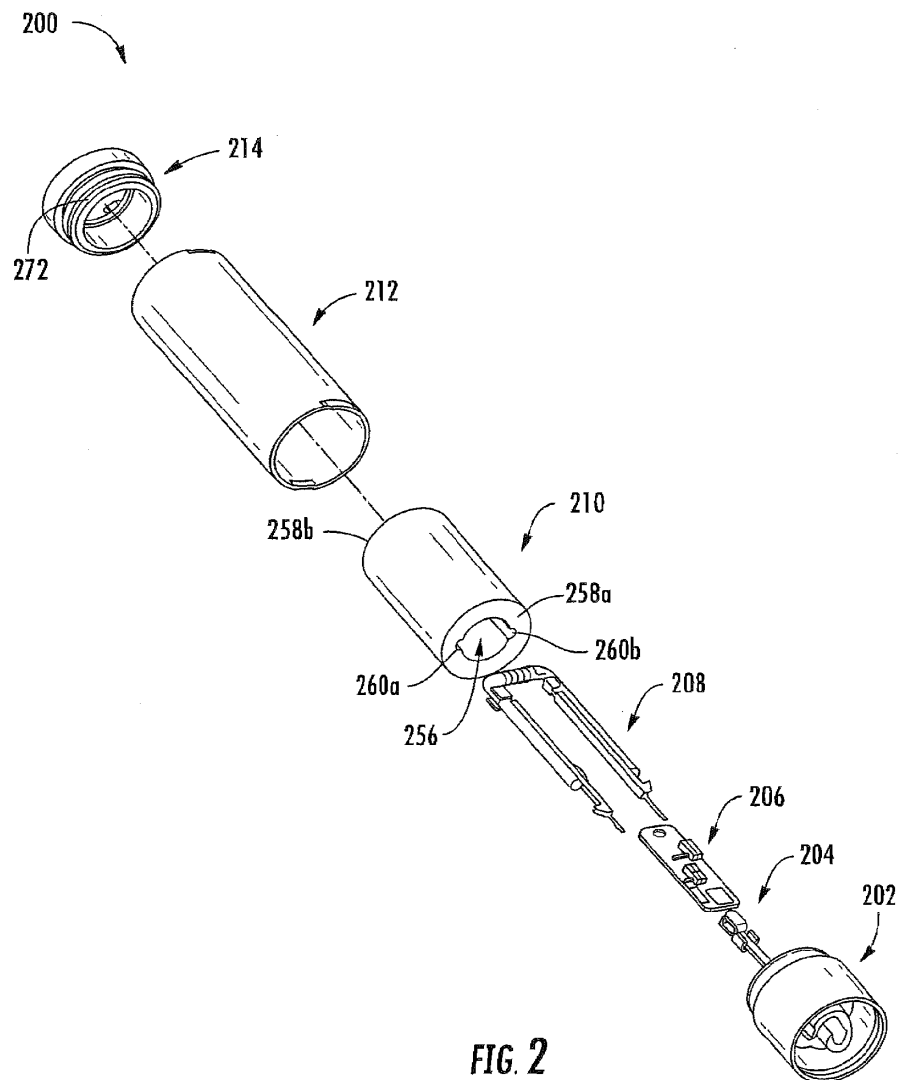
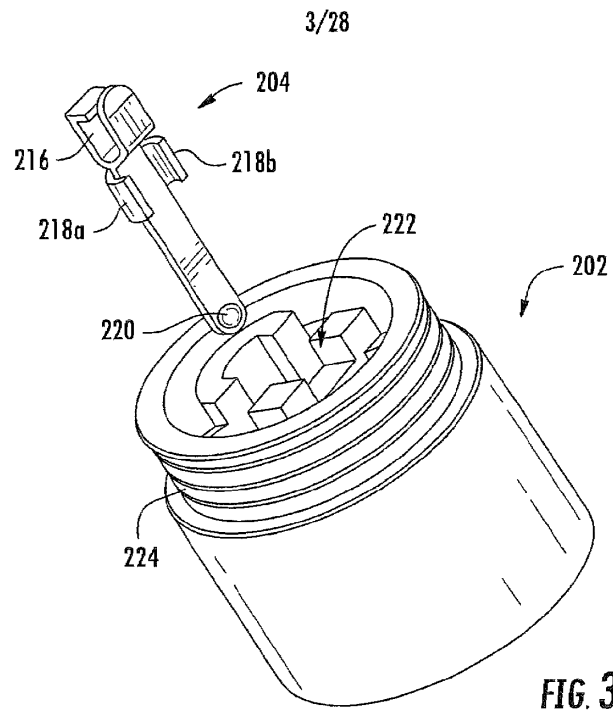
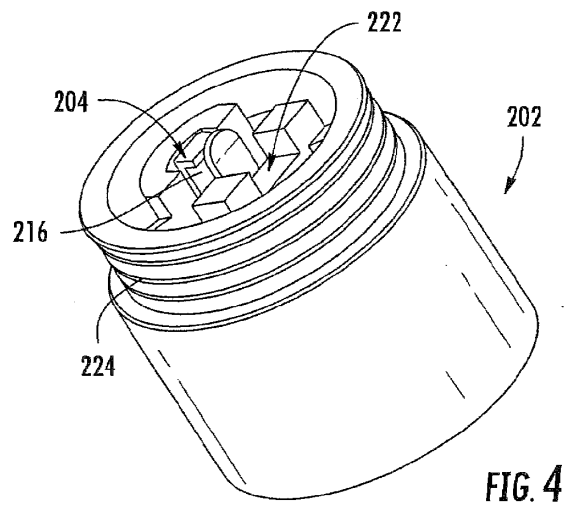


FIG. 2



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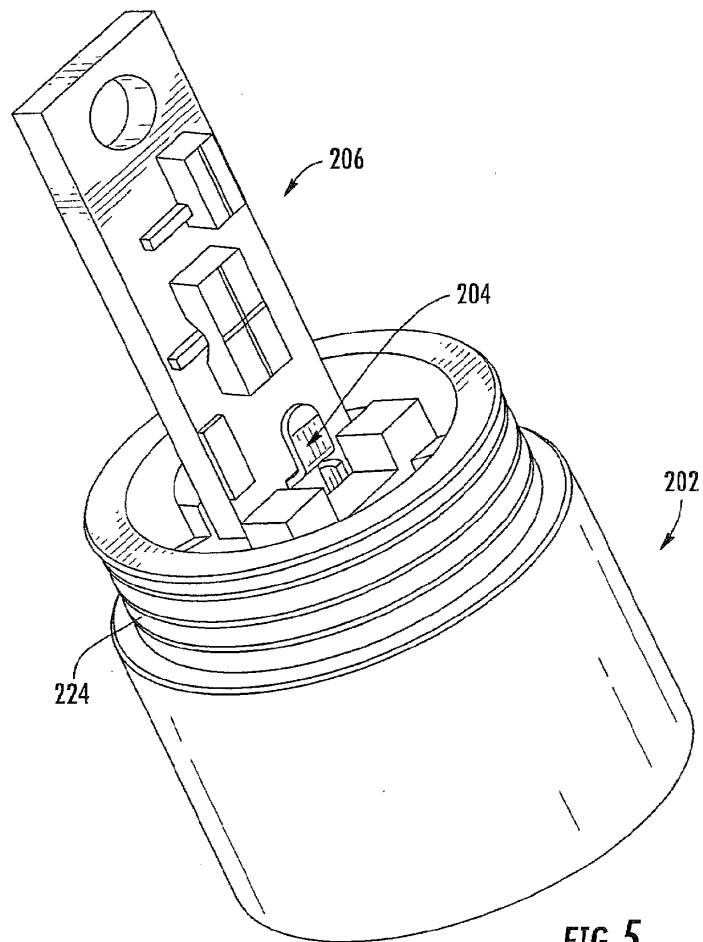


FIG. 5

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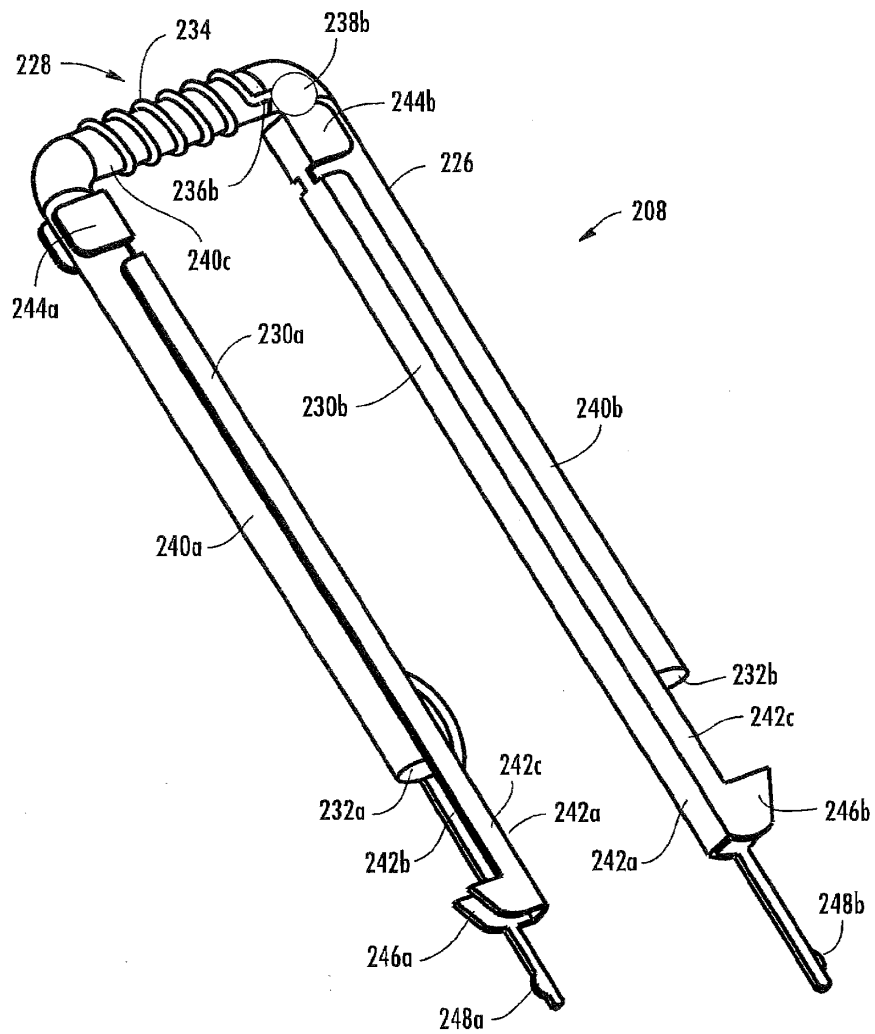
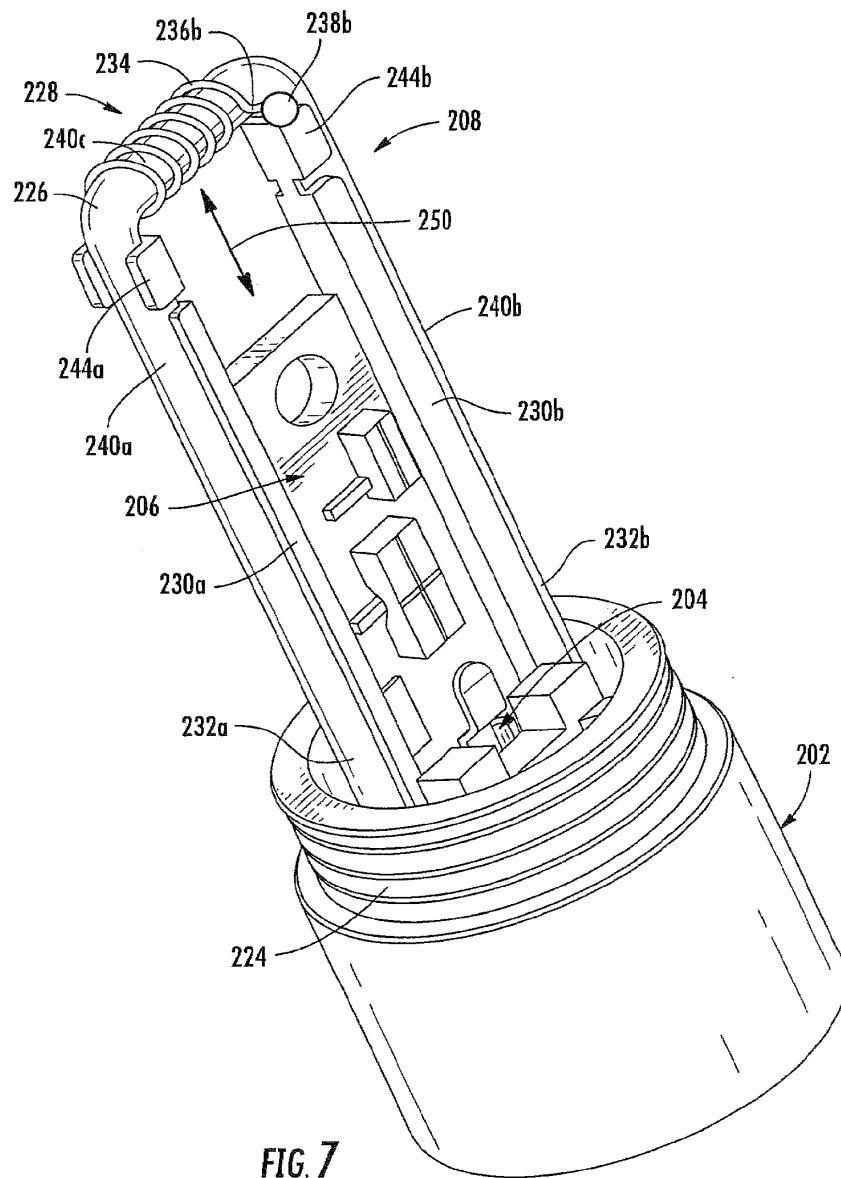
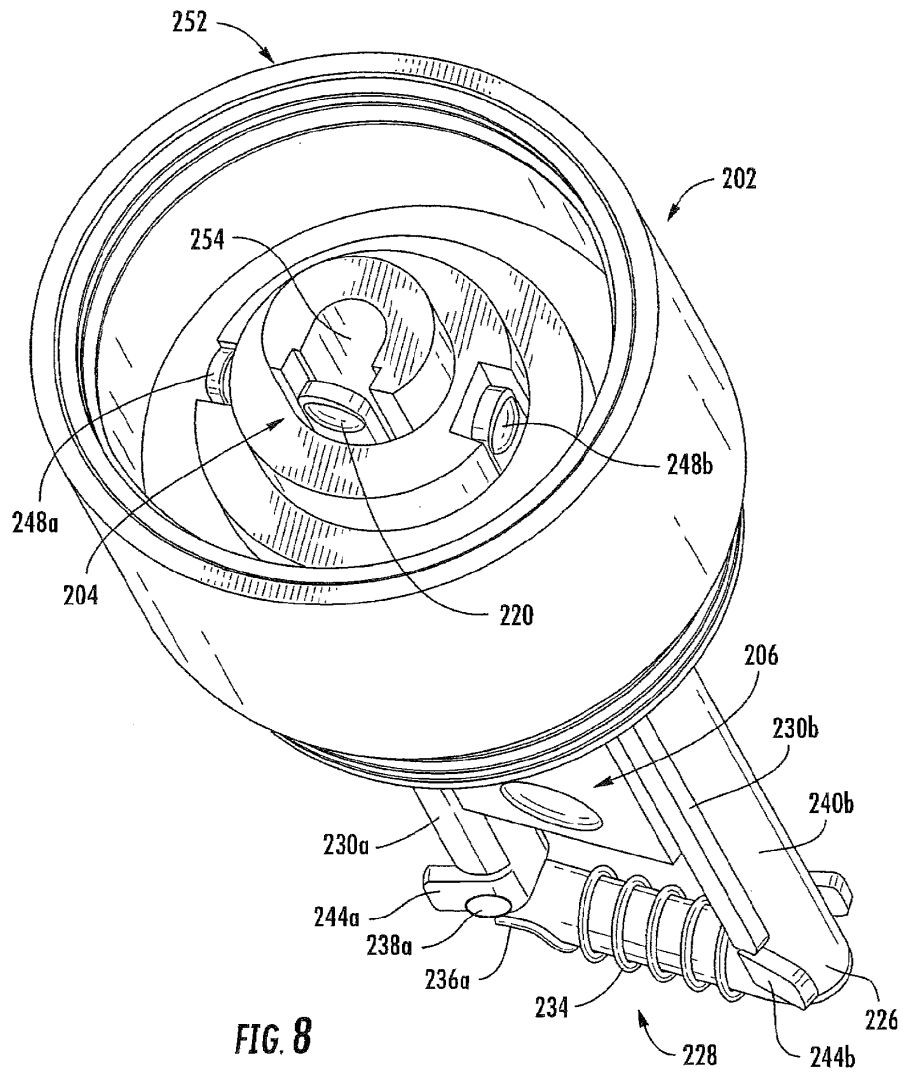


FIG. 6

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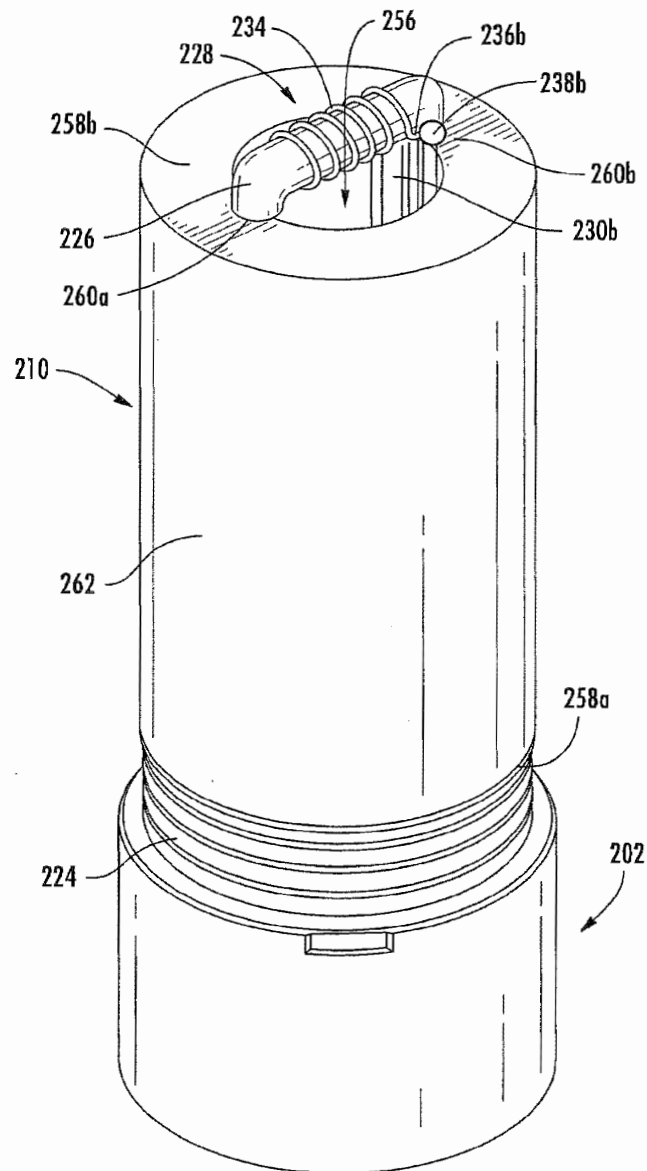


FIG. 9

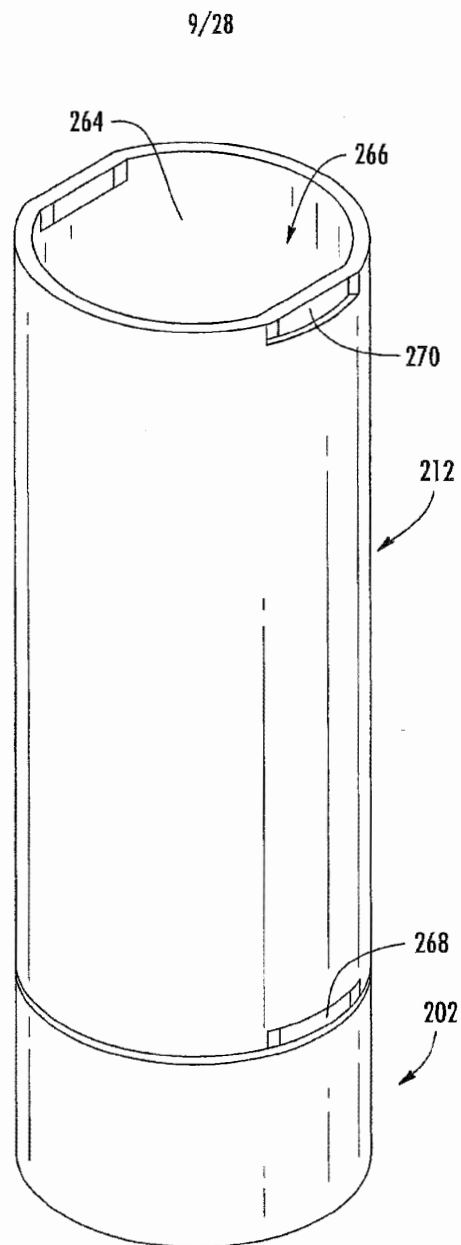


FIG. 10

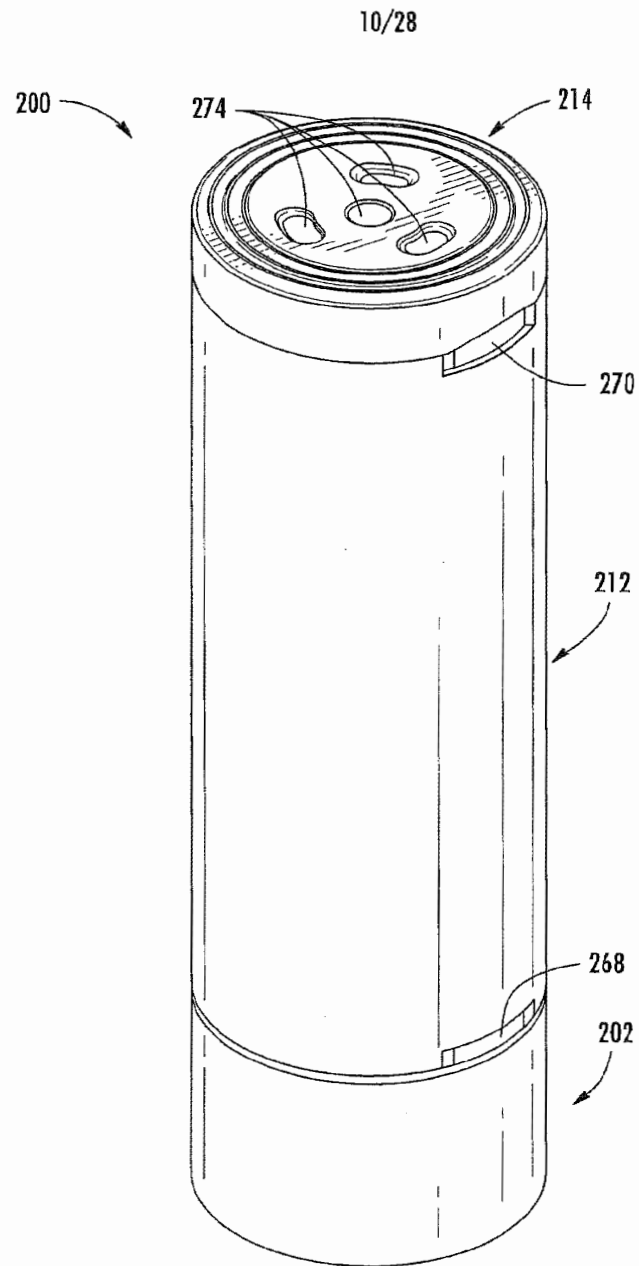


FIG. 11

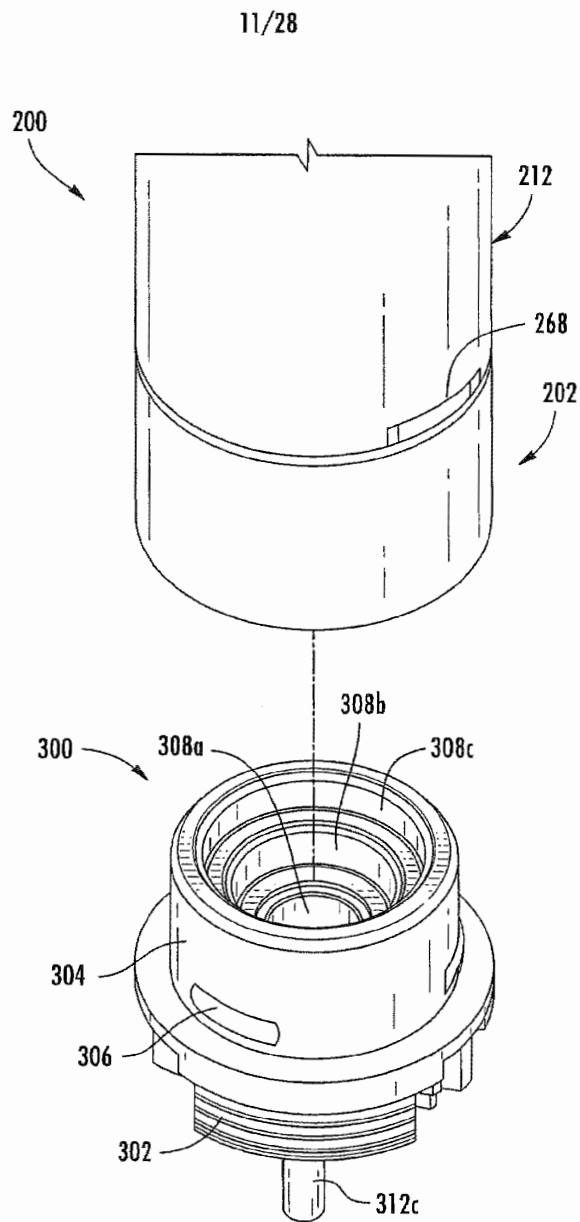
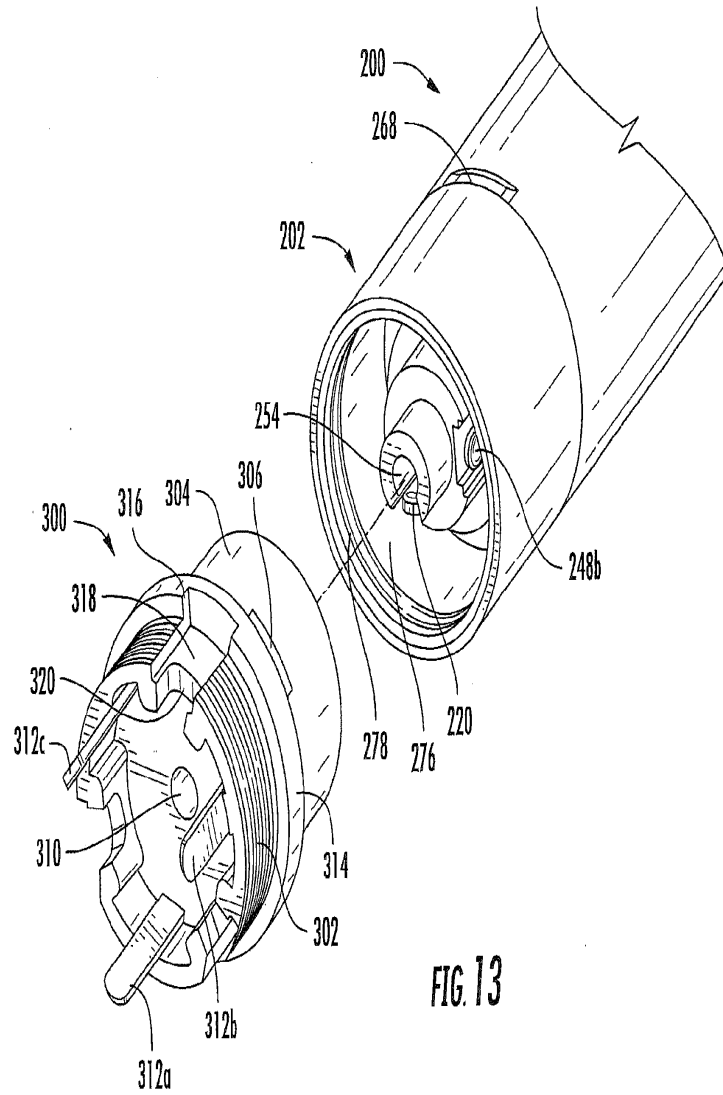


FIG. 12

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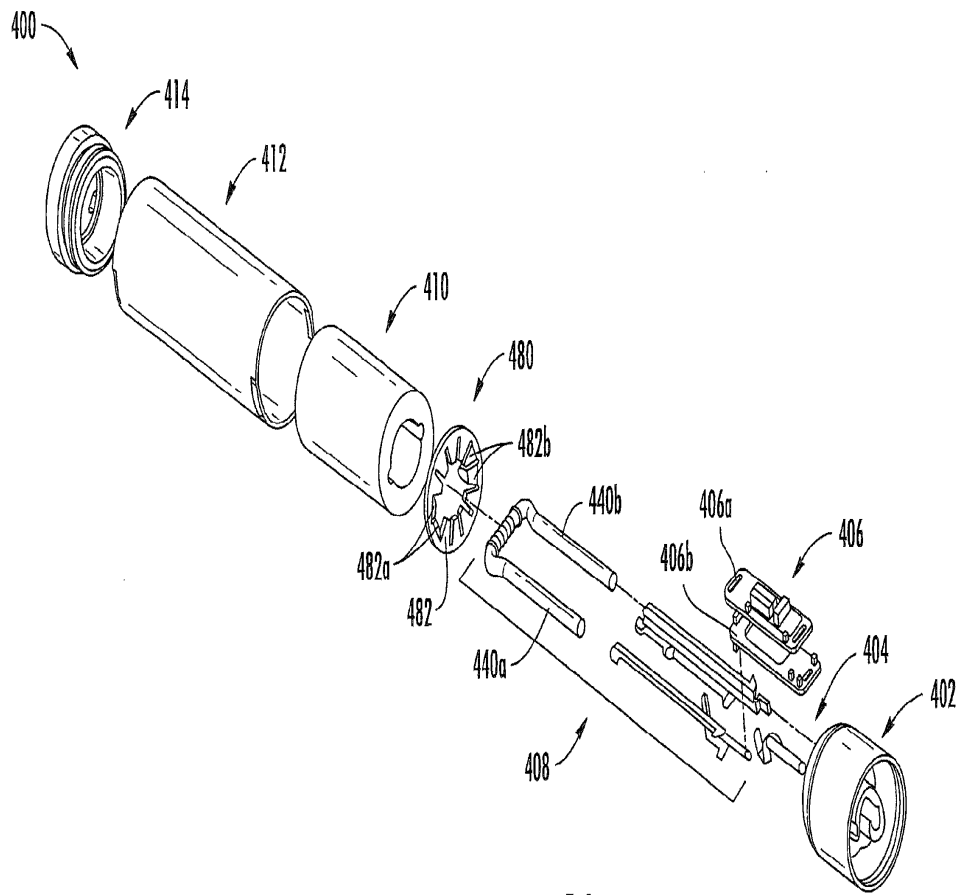
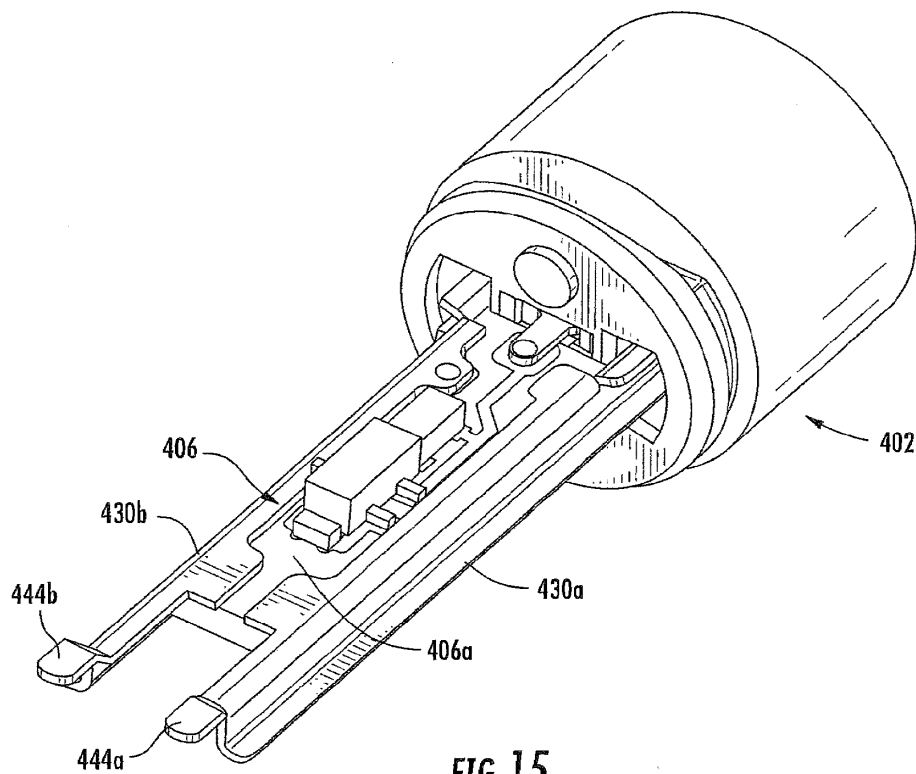


FIG. 14

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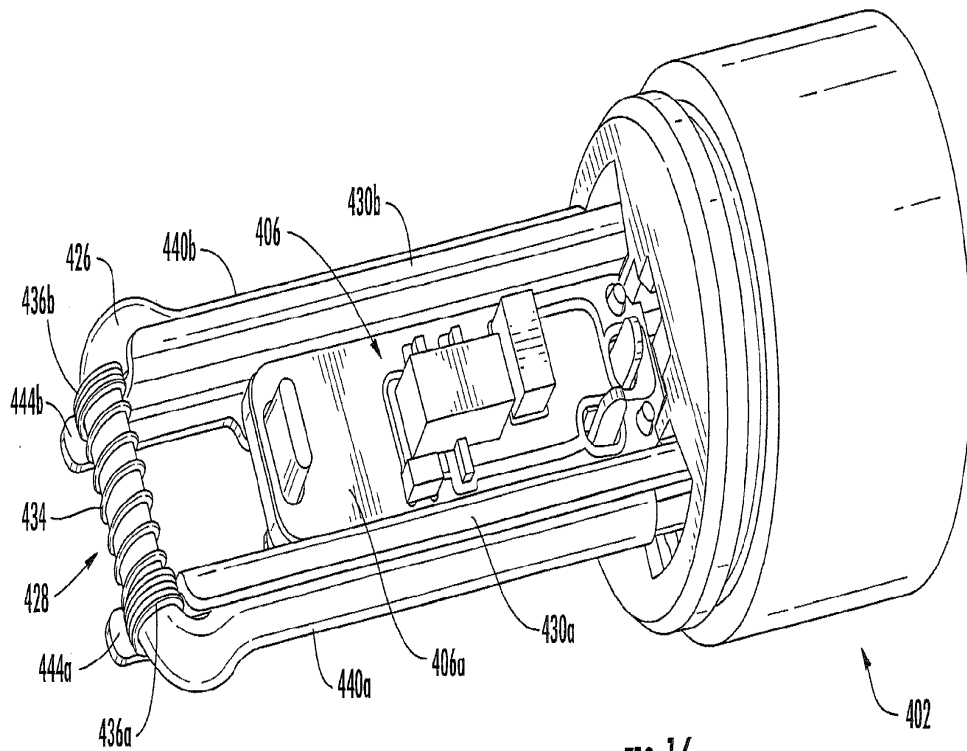


FIG. 16

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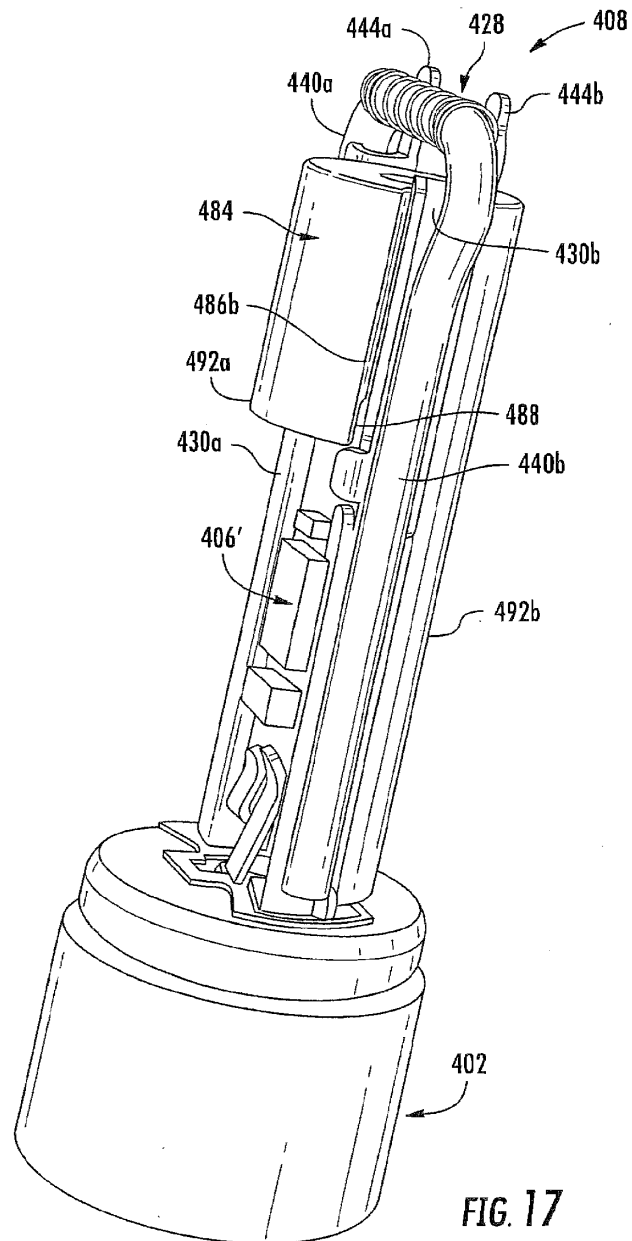
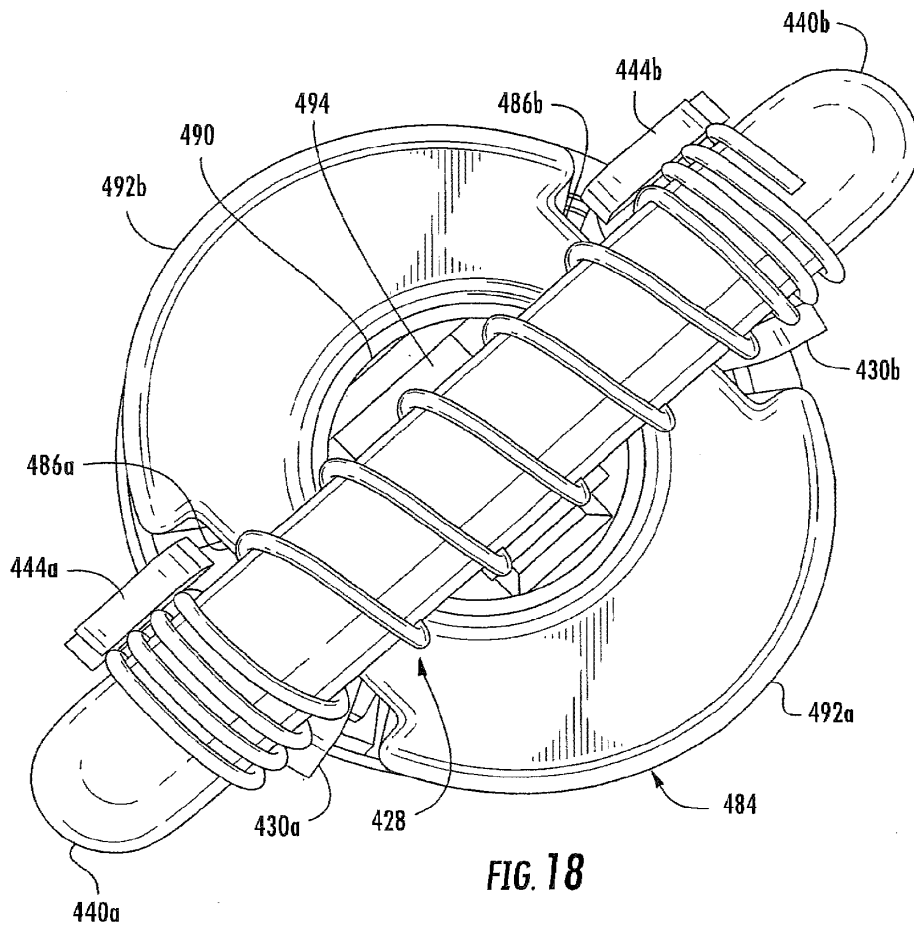
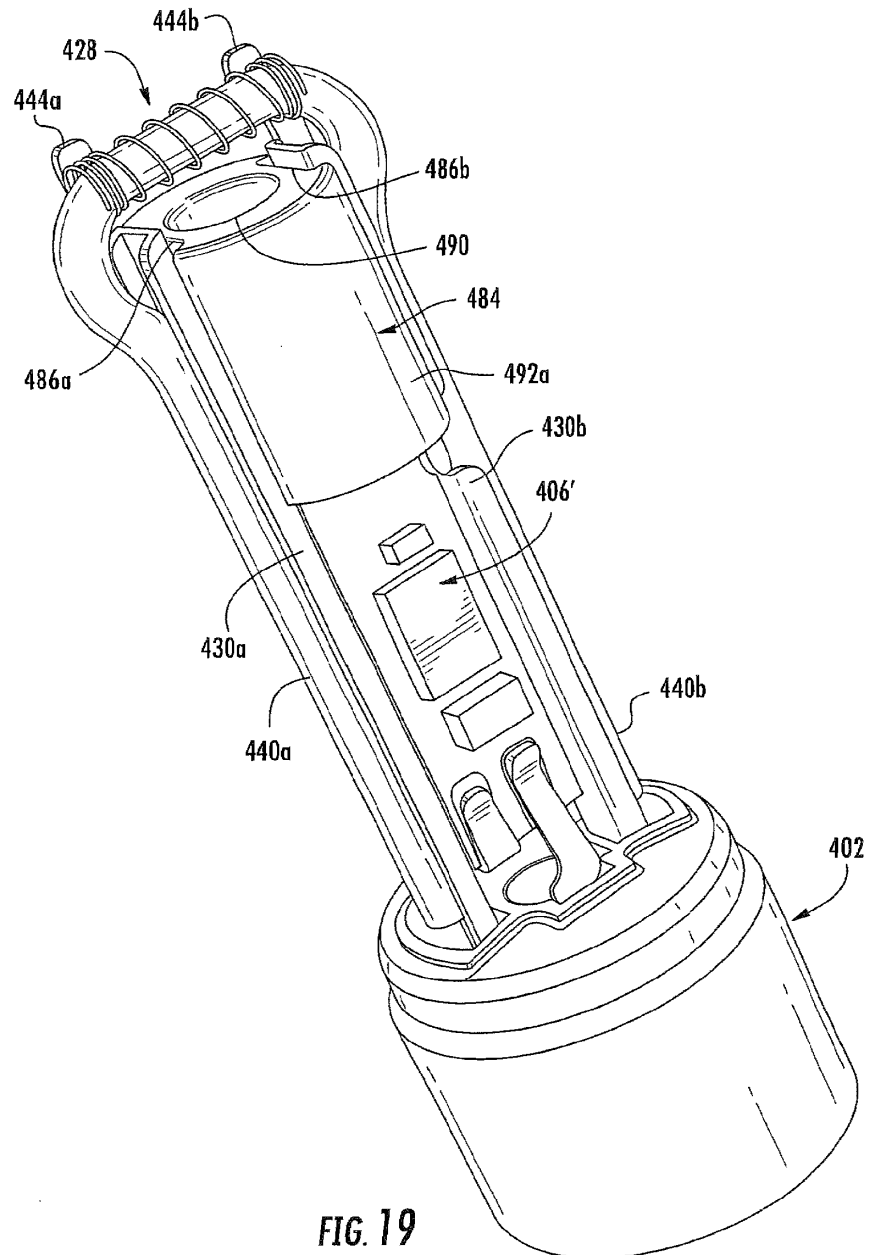


FIG. 17

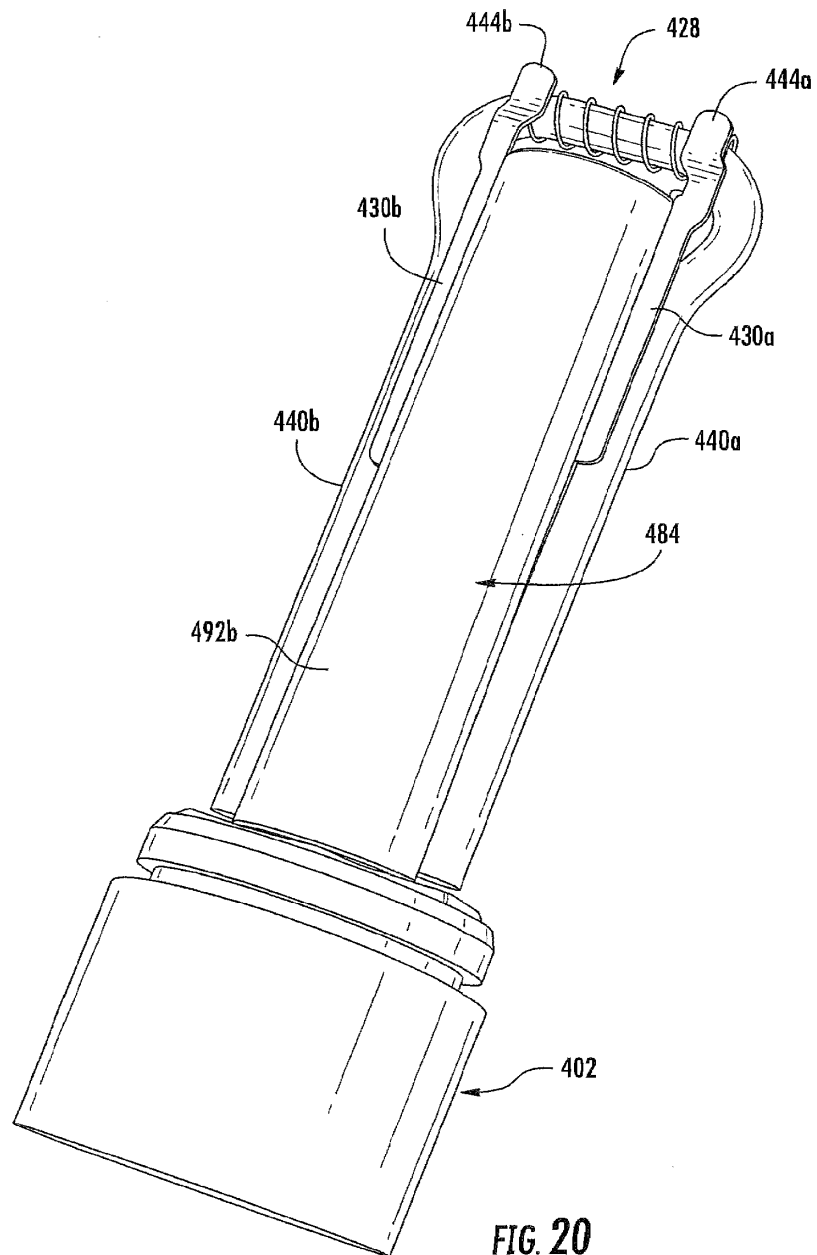
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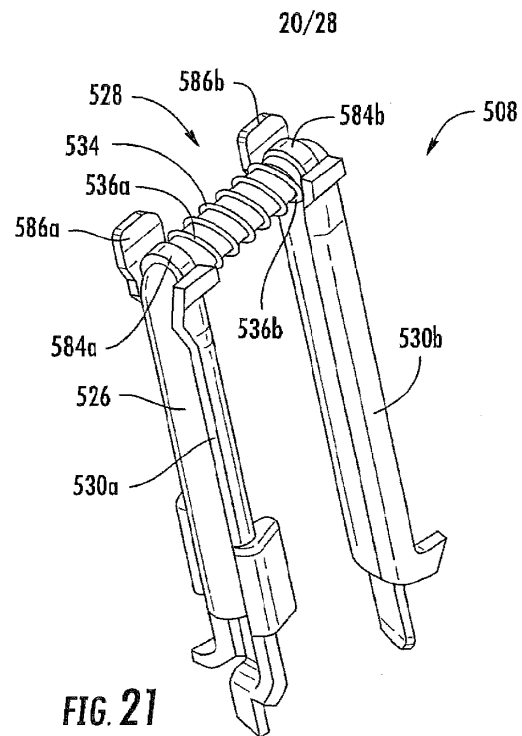
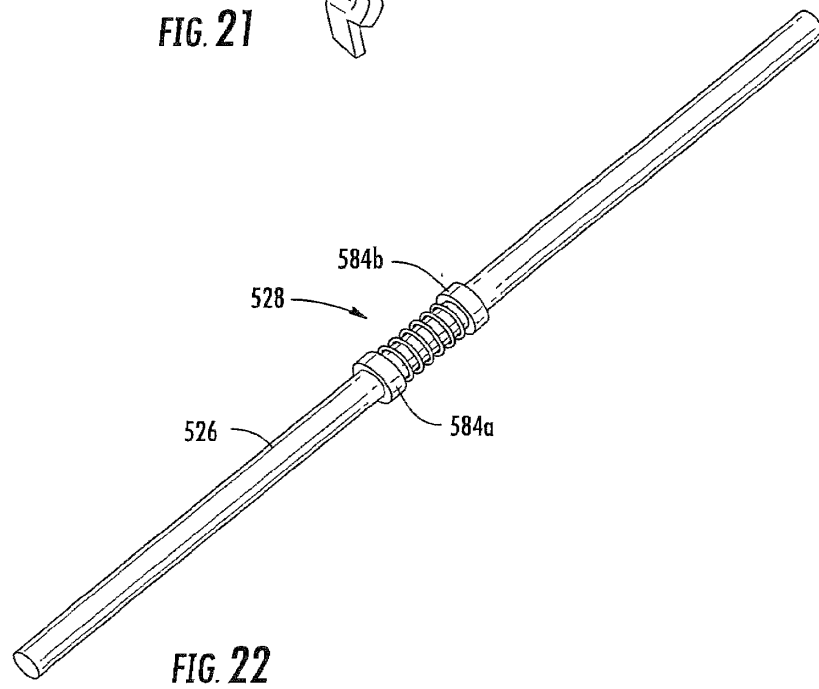


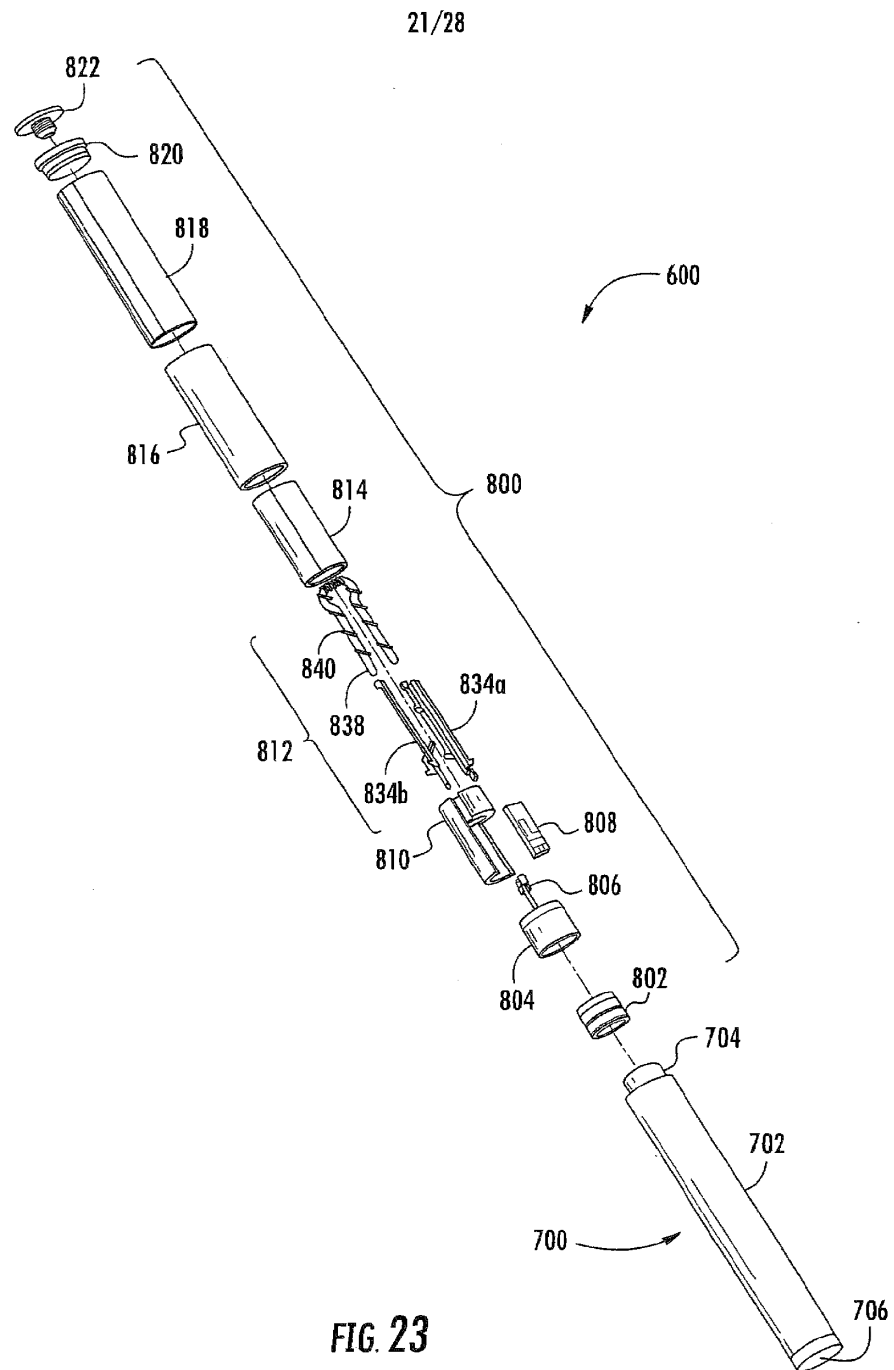
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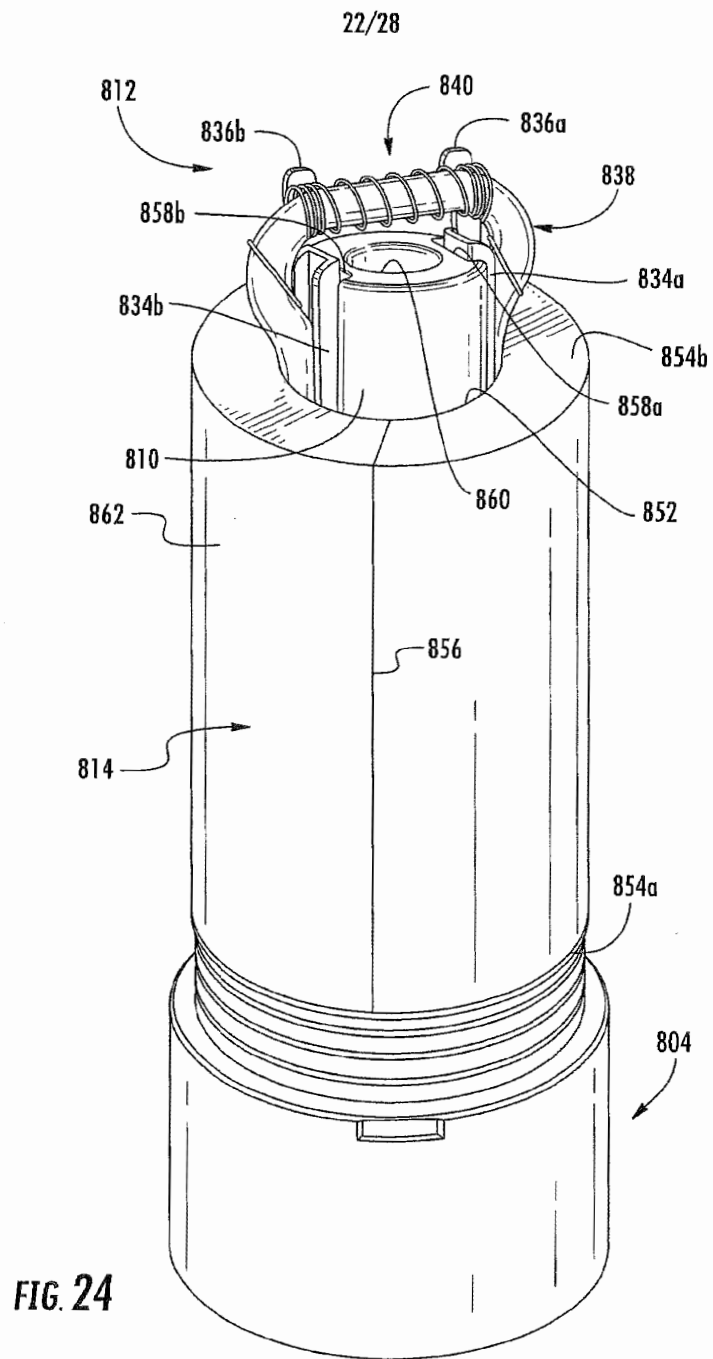


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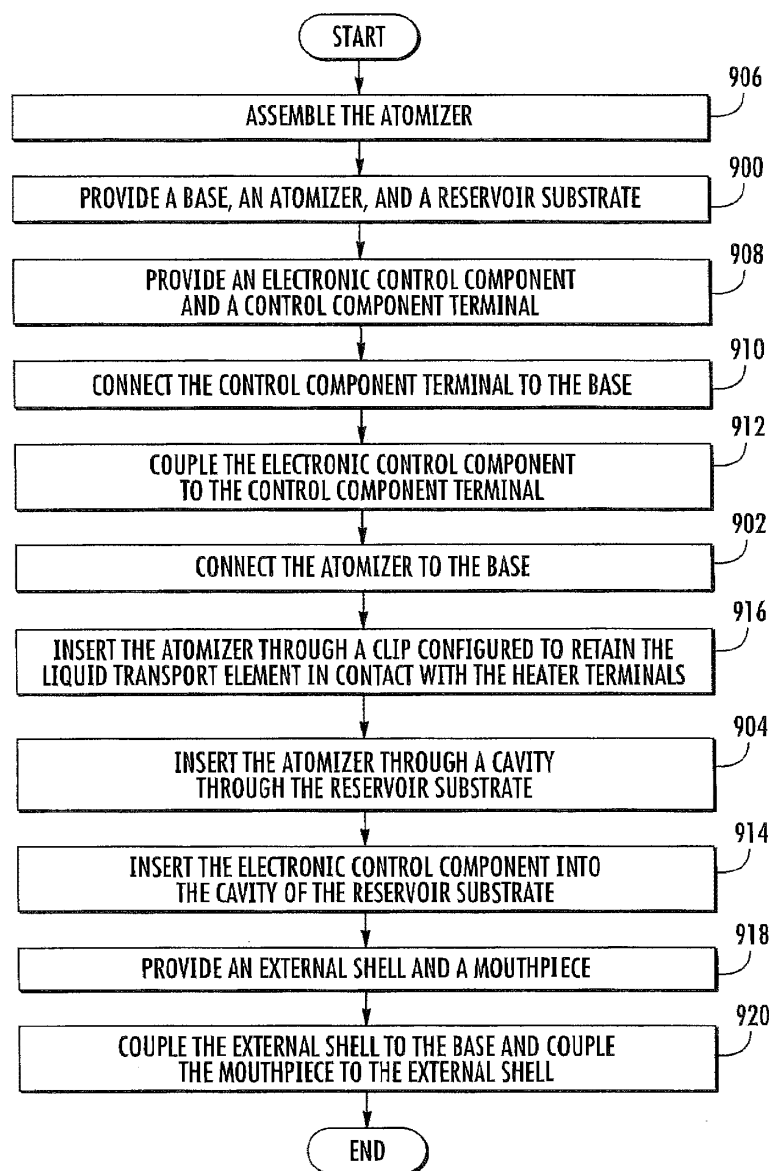


FIG. 25

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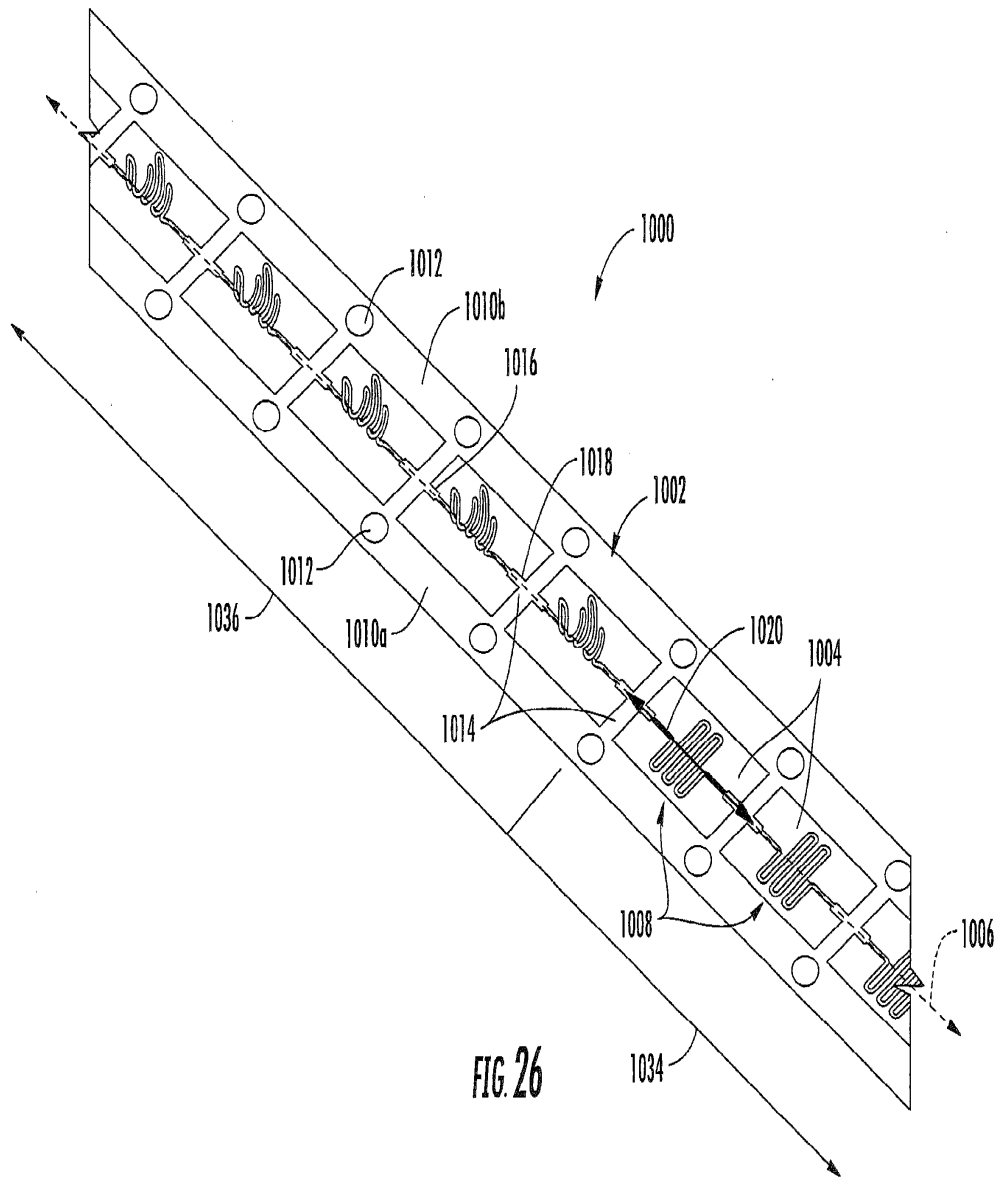
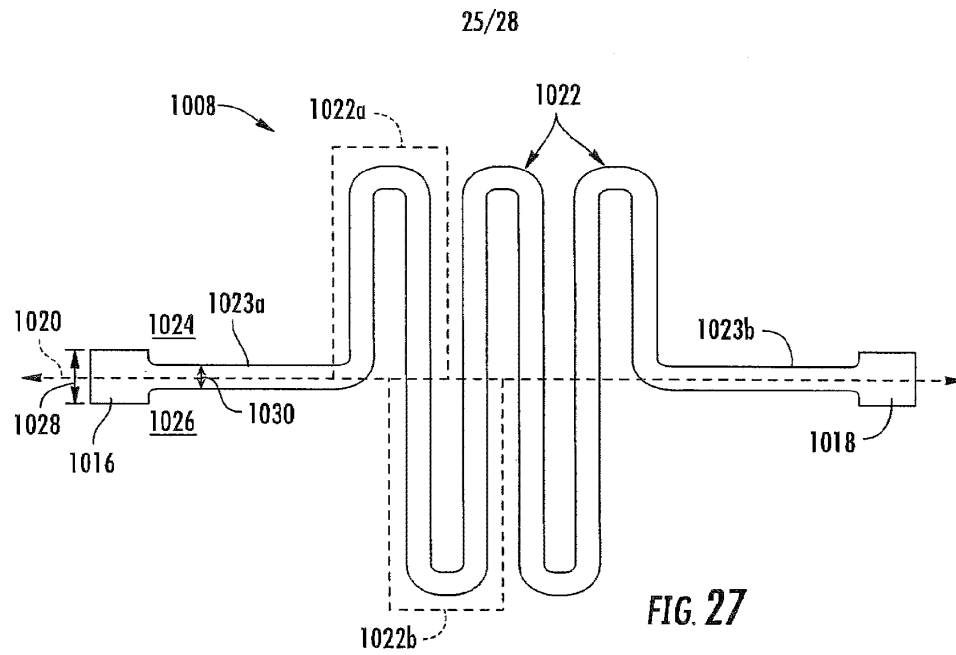
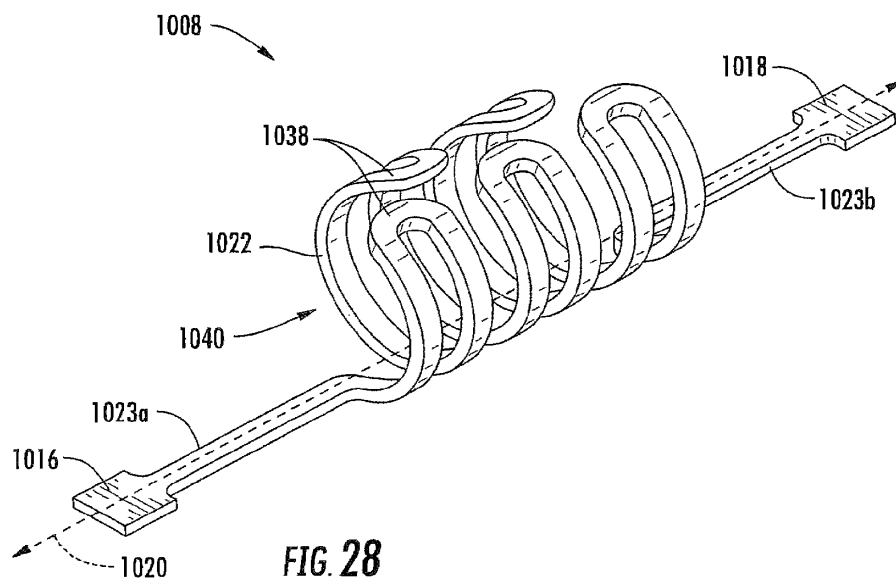


FIG. 26



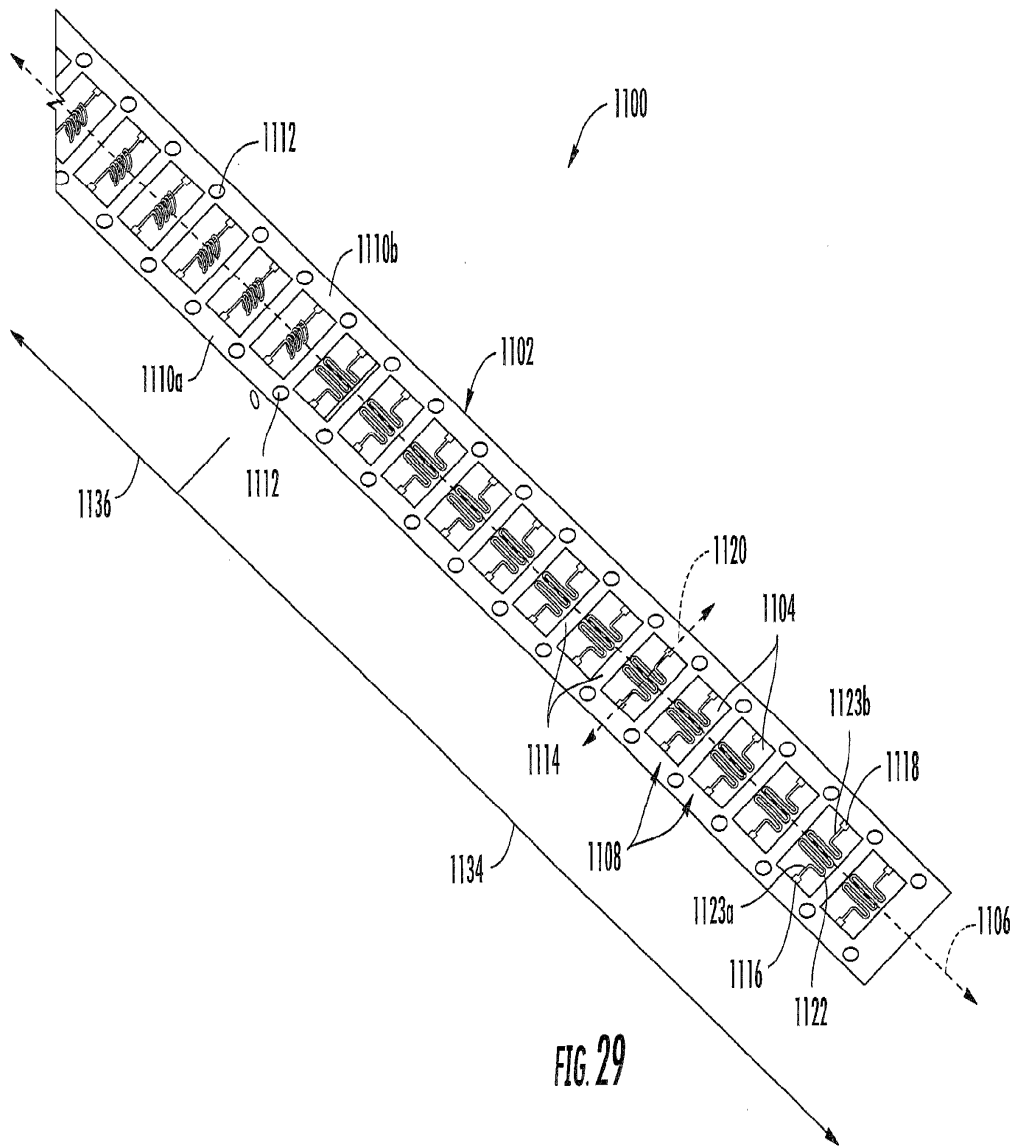
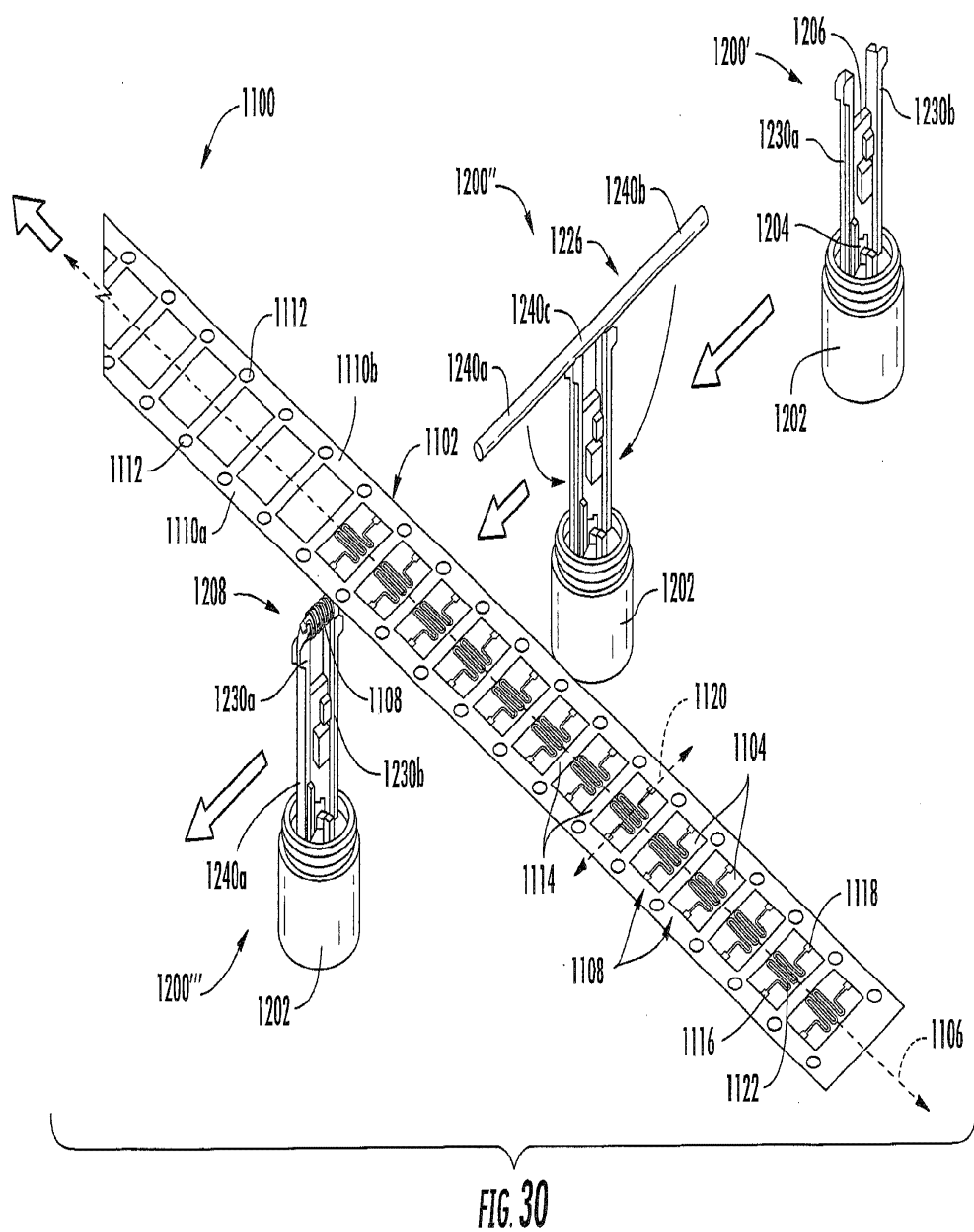


FIG. 29



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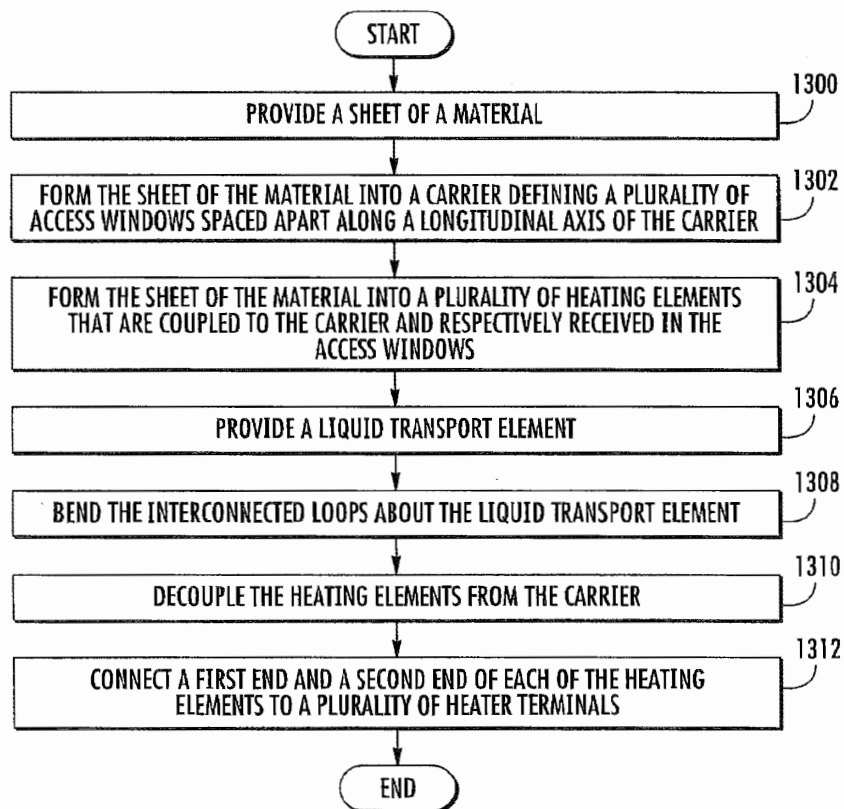


FIG. 31

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- as to the applicant's entitlement to claim the priority of the
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(54) Title: ELECTRONIC SMOKING ARTICLE WITH IMPROVED STORAGE MEANS

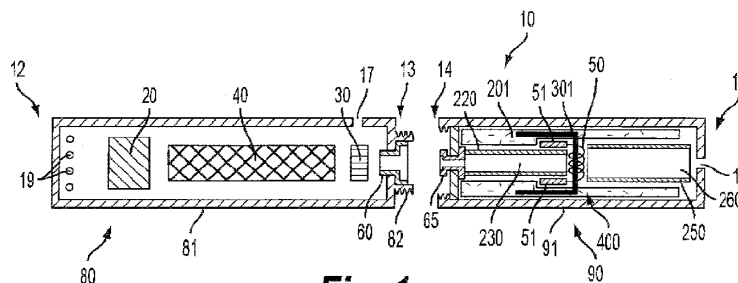


Fig. 1

(57) Abstract: The present disclosure relates to reservoirs for storing products in electronic smoking articles. The reservoir is manu-
factured from cellulose acetate fiber, thermoplastic fiber, non-thermoplastic fiber, or a combination thereof. The reservoir is substan-
tially tubular in shape and is adapted to accommodate internal components of the smoking article thereby increasing reservoir capa-
city. The internal components particularly can comprise an atomizer, which may include a braided wick.

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ELECTRONIC SMOKING ARTICLE WITH IMPROVED STORAGE MEANS

FIELD OF THE DISCLOSURE

The present disclosure relates to aerosol delivery articles and uses thereof, and in particular to articles that can be considered to be smoking articles for purposes of yielding components of tobacco and other materials in an inhalable form. Highly preferred components of such articles are made or derived from tobacco, or those articles can be characterized as otherwise incorporating tobacco for human consumption.

BACKGROUND

Many smoking devices have been proposed through the years as improvements upon, or alternatives to, smoking products that require combusting tobacco for use. Many of those devices purportedly have been designed to provide the sensations associated with cigarette, cigar, or pipe smoking, but without delivering considerable quantities of incomplete combustion and pyrolysis products that result from the burning of tobacco. To this end, there have been proposed numerous smoking products, flavor generators, and medicinal inhalers that utilize electrical energy to vaporize or heat a volatile material, or attempt to provide the sensations of cigarette, cigar, or pipe smoking without burning tobacco to a significant degree. See, for example, the various alternative smoking articles, aerosol delivery devices and heat generating sources set forth in the background art described in U.S. Pat. No. 7,726,320 to Robinson et al., US Pat. Pub. No. 2013/0255702 to Griffith, Jr. et al., US Pat. Pub. No. 2014/0000638 to Sebastian et al., US Pat. Pub. No. 2014/0060554 to Collett et al., and US Pat. App. Ser. No. 13/647,000, filed October 8, 2012, which are incorporated herein by reference.

Certain tobacco products that have employed electrical energy to produce heat for smoke or aerosol formation, and in particular, certain products that have been referred to as electronic cigarette products, have been commercially available throughout the world. Representative products that resemble many of the attributes of traditional types of cigarettes, cigars or pipes have been marketed as ACCORD[®] by Philip Morris Incorporated; ALPHA[™], JOYE 510[™] and M4[™] by InnoVapor LLC; CIRRU[™] and FLING[™] by White Cloud Cigarettes; COHITA[™], COLIBRI[™], ELITE CLASSIC[™], MAGNUM[™], PHANTOM[™] and SENSE[™] by Epuffer[®] International Inc.; DUOPRO[™], STORM[™] and VAPORKING[®] by Electronic Cigarettes, Inc.; EGAR[™] by Egar Australia; eGo-C[™] and eGo-T[™] by Joyetech; ELUSION[™] by Elusion UK Ltd; EONSMOKE[®] by Eonsmoke LLC; GREEN SMOKE[®] by Green Smoke Inc. USA;

GREENARETTE™ by Greenarette LLC; HALLIGAN™, HENDU™, JET™, MAXXQ™, PINK™ and PITBULL™ by Smoke Stik®; HEATBAR™ by Philip Morris International, Inc.; HYDRO IMPERIAL™ and LXE™ from Crown7; LOGIC™ and THE CUBAN™ by LOGIC Technology; LUCI® by Luciano Smokes Inc.; METRO® by Nicotek, LLC; NJOY® and ONEJOY™ by Sottera, Inc.; NO. 7™ by SS Choice LLC; PREMIUM ELECTRONIC CIGARETTE™ by PremiumEstore LLC; RAPP E-MYSTICK™ by Ruyan America, Inc.; RED DRAGON™ by Red Dragon Products, LLC; RUYAN® by Ruyan Group (Holdings) Ltd.; SMART SMOKER® by The Smart Smoking Electronic Cigarette Company Ltd.; SMOKE ASSIST® by Coastline Products LLC; SMOKING EVERYWHERE® by Smoking Everywhere, Inc.; V2CIGS™ by VMR Products LLC; VAPOR NINE™ by VaporNine LLC; VAPOR4LIFE® by Vapor 4 Life, Inc.; VEPPOTM by E-CigaretteDirect, LLC and VUSE® by R. J. Reynolds Vapor Company. Yet other electrically powered aerosol delivery devices, and in particular those devices that have been characterized as so-called electronic cigarettes, have been marketed under the tradenames BLU™; COOLER VISIONS™; DIRECT E-CIG™; DRAGONFLY™; EMIST™; EVERSMOKE™; GAMUCCI®; HYBRID FLAME™; KNIGHT STICKS™; ROYAL BLUEST™; SMOKETIP® and SOUTH BEACH SMOKE™.

It would be desirable to provide a smoking article that employs heat produced by electrical energy to provide the sensations of cigarette, cigar, or pipe smoking, that does so without combusting tobacco to any significant degree, that does so without the need of a combustion heat source, and that does so without necessarily delivering considerable quantities of incomplete combustion and pyrolysis products.

BRIEF SUMMARY

The present disclosure provides a smoking article and related components and methods. According to one aspect, disclosed herein is an electronic smoking article that includes an electrical power source and a reservoir that includes cellulose acetate and is configured to hold a product. The product can include an aerosol precursor composition. The reservoir can be substantially shaped as a cylinder having a hollow interior portion. The reservoir includes an exterior surface substantially adapted to conform to an interior surface of the smoking article. The reservoir can be shaped and dimensioned to accommodate one or more further components of the smoking article. The one or more further components can be an atomizer. The atomizer can include a heater such as, for example, a resistive heating element. The atomizer can further include a liquid transport element. For example, the liquid transport element can be a continuous, elongated article. The article can be adapted for wicking a liquid. The heater can be in a heating arrangement with at least

a portion of the liquid transport element. For example, the heater can be in contact with the liquid transport element and can be positioned at about a midpoint of the liquid transport element. The liquid transport element can be a braided wick. The braided wick can be a sheath/core wick, and the sheath can be braided. The core of the sheath/core wick can be a twisted yarn. The atomizer can include electrically conducting terminals extending along at least a portion of the liquid transport element and in an electrically conducting arrangement with the heater. The hollow interior of the reservoir can include a central cavity defined by an inner wall of the reservoir. Such inner wall can include one or more indentations or protrusions formed therein. For example, the inner wall can include diametrically opposed grooves extending into the reservoir. Such grooves (or similar arrangement) can be adapted to mate with at least a portion of the atomizer. The liquid transport element can be operatively positioned within the smoking article to be substantially in contact with the product. The reservoir can be formed from a cellulose acetate fiber tow. In some embodiments, the cellulose acetate fibers can have a size of about 0.5 dpf or greater, particularly about 0.5 to about 20 dpf. The hollow cellulose acetate reservoir in the shape of a tube or a cylinder can have a wall thickness of about 1 mm to about 4 mm. The reservoir can comprise about 70% to about 99% by weight cellulose acetate and about 2% to about 25% by weight of a binder. In further embodiments, the reservoir can consist of 100% cellulose acetate. If desired, further fibers and materials can be comprised with the cellulose acetate. In certain embodiments, the reservoir can be a woven or non-woven fibrous mat in the form of a tube or a hollow cylinder.

The present disclosure also provides wicks that can be particularly useful in an electronic smoking article. In certain embodiments, a wick suitable for use in an electronic smoking article can comprise a braid of at least 4 separate fibers or yarns. In particular, at least one of the fibers or yarns forming the braid can be C-glass or E-glass. In further embodiments the wick can comprise a braid of at least 8 separate fibers or yarns. Moreover, the braided wick can be a sheath/core wick. Specifically, the braided wick can be a sheath that surrounds a core. The core can be non-braided, can be formed of a different material than the braided sheath, or can be both non-braided and formed of a different material than the braided sheath. In some embodiments, the core can comprise a twisted yarn.

In further embodiments, the present disclosure can provide an electronic smoking article comprising a reservoir with an aerosol precursor composition (e.g., a liquid composition) stored therein and a braided wick in fluid communication with the reservoir. The braided wick can be as discussed above. The reservoir particularly may be substantially shaped as a cylinder or be tube shaped and have a hollow interior portion. The reservoir particularly can comprise cellulose acetate. The reservoir may be a molded element. The reservoir also may be a woven or non-woven

fibrous mat, such as comprising fibers of cellulose acetate. The fibrous mat can be rolled or otherwise formed to the tube or hollow cylinder shape.

In other embodiments, the present disclosure can provide a cartridge for an electronic smoking article. The cartridge can comprise an atomizer at least partially positioned within a hollow interior of a tube-shaped reservoir adapted for holding an aerosol precursor composition, the reservoir tube being positioned within a hollow shell. In particular, the reservoir tube can be formed of cellulose acetate. The atomizer specifically can comprise a continuous, elongated wick having two opposing ends, a heater in connection with the wick and positioned at about a midpoint thereof, and electrically conducting terminals positioned in physical contact with the wick and in electrical connection with the heater. The hollow shell can comprise a first end adapted to engage a control component (e.g., a controller or power unit of an electronic smoking article) and an opposing mouthend. The heater of the atomizer can extend out of the reservoir tube in a cavity formed at the mouthend of the hollow shell. The wick can be a braided wick as discussed herein.

In another aspect, a method of making an electronic smoking article is provided. The method includes the step of providing a cylinder comprising cellulose acetate having a hollow interior portion. At least part of the hollow interior can be shaped and dimensioned to accommodate one or more further components of the smoking article. The method further includes the step of inserting an atomizer into the hollow interior of the cellulose acetate cylinder. The method can further include the steps of inserting the cylinder and atomizer into a hollow shell and connecting the atomizer to a power source. The power source can be a battery. The hollow shell can be a cartridge portion of the electronic smoking article.

BRIEF DESCRIPTION OF THE FIGURES

Having thus described the disclosure in the foregoing general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a sectional view through an embodiment of a smoking article;

FIG. 2 illustrates a partial cut-away view of an electronic smoking article containing a reservoir according to an embodiment of the present disclosure;

FIG. 3 illustrates an exploded view of an electronic smoking article containing a reservoir and an atomizer according to an embodiment of the present disclosure;

FIG. 4 provides a perspective view of a combined reservoir and atomizer according to one embodiment of the disclosure;

FIG. 5 is a cross-section of a sheath/core wick according to an exemplary embodiment of the present disclosure;

FIG. 6 and FIG. 7 are images of a reservoir according to an embodiment of the present disclosure and a comparative reservoir after being placed in a liquid composition to evaluate the ability of the reservoir to become saturated by the liquid;

FIG. 8 is an image of a reservoir according to an embodiment of the present disclosure being saturated with an aerosol precursor composition;

FIG. 9 is an image of the reservoir from FIG. 8 after depletion of the aerosol precursor composition through use of the reservoir in an aerosolization smoking article;

FIG. 10 is a graph illustrating aerosol forming efficiency of reservoirs according to embodiments of the present disclosure;

FIG. 11 is a graph illustrating the change in average mg of total particulate matter (TPM) delivered in a puff of an aerosolization smoking article utilizing a twisted wick or a braided wick according to an embodiment of the present disclosure; and

FIG. 12 is a graph illustrating the change in average mg of total particulate matter (TPM) delivered in a puff of an aerosolization smoking article including braided wicks according to embodiments of the present disclosure formed from 8, 12, or 16 separate fiberglass yarns.

DETAILED DESCRIPTION

The present disclosure will now be described more fully hereinafter with reference to exemplary embodiments thereof. These exemplary embodiments are described so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art. Indeed, the present disclosure may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. As used in the specification, and in the appended claims, the singular forms “a”, “an”, “the”, include plural referents unless the context clearly dictates otherwise.

The present disclosure relates to articles that use electrical energy to heat a material (preferably without combusting the material to any significant degree) to form an inhalable substance, the articles being sufficiently compact to be considered “hand-held” devices. Particularly, the present disclosure relates to reservoirs for storing aerosol precursor compositions in electronic smoking articles. The reservoir can be fibrous and can be made from a variety of fibers. For example, the reservoir can be manufactured from cellulose acetate fiber. The reservoir can be substantially tubular in shape and can be adapted to accommodate further internal components of the smoking article.

The present disclosure relates to articles (and the manufacture thereof) that use electrical energy to heat a material (preferably without combusting the material to any significant degree) to form an inhalable substance, the articles being sufficiently compact to be considered “hand-held” devices. In certain embodiments, the articles can particularly be characterized as smoking articles. As used herein, the term “smoking article” is intended to mean an article that provides many of the sensations (e.g., inhalation and exhalation rituals, types of tastes or flavors, organoleptic effects, physical feel, use rituals, visual cues such as those provided by visible aerosol, and the like) of smoking a cigarette, cigar, or pipe without any substantial degree of combustion of any component of the article. As used herein, the term “smoking article” does not necessarily mean that, in operation, the article produces smoke in the sense of the aerosol resulting from by-product of combustion or pyrolysis of tobacco, but rather, that the article yields vapors (including vapors within aerosols that can be considered to be visible aerosols that might be considered to be described as smoke-like) resulting from volatilization or vaporization of certain components of the article or device. In highly preferred embodiments, articles characterized as smoking articles incorporate tobacco and/or components derived from tobacco.

In further embodiments, the articles that can be manufactured according to the present disclosure can be characterized as being vapor-producing articles, aerosolization articles, or medicament delivery articles. Thus, the articles can be arranged so as to provide one or more substances (e.g., flavors and/or pharmaceutical active ingredients) in an inhalable form or state. For example, inhalable substances can be substantially in the form of a vapor (i.e., a substance that is in the gas phase at a temperature lower than its critical point). Alternatively, inhalable substances can be in the form of an aerosol (i.e., a suspension of fine solid particles or liquid droplets in a gas). For purposes of simplicity, the term “aerosol” as used herein is meant to include vapors, gases and aerosols of a form or type suitable for human inhalation, whether or not visible, and whether or not of a form that might be considered to be smoke-like.

In use, smoking articles according to the disclosure may be subjected to many of the physical actions of an individual in using a traditional type of smoking article (e.g., a cigarette, cigar or pipe that is employed by lighting with a flame and used by inhaling tobacco that is subsequently burned). For example, the user of a smoking article of the present invention can hold that article much like a traditional type of smoking article, draw on one end of that article for inhalation of aerosol produced by that article, and take puffs at selected intervals of time.

A smoking article that can be manufactured according to one aspect of the present disclosure can include a number of components provided within an outer shell or body. The overall design of the outer shell or body can vary, and the format or configuration of the outer body that

can define the overall size and shape of the smoking article can vary. Typically, an elongated body resembling shape of a cigarette or cigar can be a formed from a single, unitary shell; or the elongated body can be formed of two or more separable pieces. For example, a smoking article can comprise an elongated shell or body that can be substantially tubular in shape, and as such, resemble the shape of a conventional cigarette or cigar. In one embodiment, all of the components of the smoking article are contained within one outer body or shell. Alternatively, a smoking article can comprise two shells that are joined and are separable. For example, a smoking article can possess at one end a control body comprising a shell containing one or more reusable components (e.g., a rechargeable battery and various electronics for controlling the operation of that article), and at the other end and removably attached thereto a shell containing a disposable portion (e.g., a disposable flavor-containing cartridge). Additionally, various smoking article designs and component arrangements can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

A smoking article that can be manufactured according to one aspect of the present disclosure can include some combination of power source (i.e., an electrical power source), at least one control component (e.g., means for actuating, controlling, regulating and ceasing power for heat generation, such as by controlling electrical current flow the power source to other components of the article), a heater or heat generation component (e.g., an electrical resistance heating element or component commonly referred to as an “atomizer”), and an aerosol precursor component (e.g., commonly a liquid capable of yielding an aerosol upon application of sufficient heat, such as ingredients commonly referred to as “smoke juice,” “e-liquid” and “e-juice”), and a mouthend region or tip for allowing draw upon the smoking article for aerosol inhalation (e.g., a defined air flow path through the article such that aerosol generated can be withdrawn therefrom upon draw). Alignment of the components within the article can vary. In specific embodiments, the aerosol precursor component can be located near an end of the article (e.g., with a cartridge, which in certain circumstances can be replaceable and disposable) that is proximal to the mouth of a user so as to maximize aerosol delivery to the user. Other configurations, however, are not excluded. Generally, the heater component can be positioned sufficiently near that aerosol precursor component so that heat from the heater component can volatilize the aerosol precursor (as well as one or more flavorants, medicaments, or the like that may likewise be provided for delivery to a user) and form an aerosol for delivery to the user. When the heating member heats the aerosol precursor component, an aerosol is formed, released, or generated in a physical form suitable for inhalation by a consumer. It should be noted that the foregoing terms are meant to be

interchangeable such that reference to release, releasing, releases, or released includes form or generate, forming or generating, forms or generates, and formed or generated. Specifically, an inhalable substance is released in the form of a vapor or aerosol or mixture thereof. Additionally, the selection of various smoking article components can be appreciated upon consideration of the commercially available electronic smoking articles, such as those representative products listed in the background art section of the present disclosure.

A smoking article that can be manufactured according to one aspect of the present disclosure can include a battery or other electrical power source to provide current flow sufficient to provide various functionalities to the article, such as resistive heating, powering of control systems, powering of indicators, and the like. The power source can take on various embodiments. Preferably, the power source is able to deliver sufficient power to rapidly heat the heating member to provide for aerosol formation and power the article through use for the desired duration of time. The power source preferably is sized to fit conveniently within the article so that the article can be easily handled; and additionally, preferred a preferred power source is of a sufficiently light weight to not detract from a desirable smoking experience.

An exemplary smoking article 10 according to the disclosure is shown in FIG. 1. As seen in the surface illustrated therein, the smoking article 10 can comprise a control body 80 and a cartridge 90 that can be aligned in a functioning relationship. In this regard, the control body 80 and the cartridge 90 may be attachable and detachable from each other. Although a threaded engagement is illustrated in FIG. 1, it is understood that further means of engagement are encompassed, such as a press-fit engagement, a magnetic engagement, or the like. The cartridge can particularly include a single use connector as otherwise described herein.

In specific embodiments, the control body 80 may be referred to as being reusable, and the cartridge 90 may be referred to as being disposable. In some embodiments, the entire smoking article may be characterized as being disposable in that the control body may be configured for only a limited number of uses (e.g., until a battery power component no longer provides sufficient power to the smoking article) with a limited number of cartridges and, thereafter, the entire smoking article 10, including the control body, may be discarded. In other embodiments, the control body may have a replaceable battery such that the control body can be reused through a number of battery exchanges and with many cartridges. Similarly, the smoking article 10 may be rechargeable and thus may be combined with any type of recharging technology, including connection to a typical electrical outlet, connection to a car charger (i.e., cigarette lighter receptacle), and connection to a computer, such as through a USB cable.

The control body 80 includes a control component 20, a flow sensor 30, and a battery 40. Although these components are illustrated in a specific alignment, it is understood that various alignments of the components are encompassed by the present disclosure. The control body 80 further includes a plurality of indicators 19 at a distal end 12 of the control body shell 81. Such indicators 19 can show the number of puffs taken or remaining from the smoking article, can be indicative of an active or inactive status, can light up in response to a puff, or the like. The indicators can be provided in varying numbers and can take on different shapes and can even be simply an opening in the body (such as for release of sound when such indicators are present).

Various positions for one or more air intakes 17 are encompassed by the present disclosure. As shown, the air intake 17 may be positioned in the control body shell 81 such that air drawn through the intake sufficiently contacts the flow sensor 30 to activate the sensor (although other positions are encompassed, particularly if different sensing means are provided or if manual actuation, such as with a push button, is provided). A receptacle 60 also is included at the proximal attachment end 13 of the control body 80 and extends into the control body projection 82 to allow for ease of electrical connection with the resistive heating element 50 when the cartridge 90 is attached to the control body. In the illustrated embodiment, the receptacle 60 includes a central open passage to facilitate air flow from the air intake in the control body into the cartridge during use of the article 10.

The cartridge 90 includes a cartridge shell 91 with a mouth opening 18 at the mouthend 11 thereof to allow passage of air and entrained vapor (i.e., the components of the aerosol precursor composition in an inhalable form) from the cartridge to a consumer during draw on the smoking article 10. The smoking article 10 according to the present disclosure may have an overall shape that may be defined as being substantially rod-like or substantially tubular shaped or substantially cylindrically shaped. As illustrated in FIG. 1, the smoking article 10 has a substantially round cross-section; however, other cross-sectional shapes (e.g., oval, square, triangle, etc.) also are encompassed by the present disclosure. Such language that is descriptive of the physical shape of the smoking article may also be applied to the individual units of the smoking article in embodiments comprising multiple units, such as a control body and a cartridge.

In preferred embodiments, the smoking article 10 may take on a size that is comparative to a cigarette or cigar shape. Thus, the smoking article may have a diameter of about 5 mm to about 25 mm, about 5 mm to about 20 mm, about 6 mm to about 15 mm, or about 6 mm to about 10 mm. Such dimension may particularly correspond to the outer diameter of the control body shell 81 and/or the cartridge shell 91. The control body can have a length of about 50 mm to about 110 mm, about 60 mm to about 100 mm, or about 65 mm to about 95 mm. The cartridge can have a length

of about 20 mm to about 60 mm, about 25 mm to about 55 mm, or about 30 mm to about 50 mm. The overall length of the combined cartridge and control body (or the overall length of a smoking article according to the disclosure formed of a single, unitary shell) can be approximately equal to or less than the length of a typical cigarette – e.g., about 70 mm to about 130 mm, about 80 mm to about 125 mm, or about 90 mm to about 120 mm.

The cartridge shell 91 of the smoking article 10 can be formed of any material suitable for forming and maintaining an appropriate conformation, such as a tubular shape, and for retaining therein the suitable components of the smoking article. The body can be formed of a single wall, as shown in FIG. 1. The cartridge shell 91 can be formed of a material (natural or synthetic) that is heat resistant so as to retain its structural integrity – e.g., does not degrade – at least at a temperature that is the heating temperature provided by the resistive heating element. In some embodiments, a heat resistant polymer may be used. In other embodiments, the body can be formed from paper, or from metal, such as stainless steel. As further discussed herein, the body, such as a paper tube, may have one or more layers associated therewith that function to substantially prevent movement of vapor therethrough. In one example, an aluminum foil layer may be laminated to one surface of the body. Ceramic materials also may be used.

The cartridge 90 further includes a resistive heating element 50 in the form of a metal wire coil. The resistive heating element includes terminals 51 (e.g., positive and negative terminals) at the opposing ends thereof for facilitating current flow through the resistive heating element and for attachment of the appropriate wiring (not illustrated) to form an electrical connection of the resistive heating element with the battery 40 when the cartridge 90 is connected to the control body 80. Specifically, a plug 65 is positioned at the distal attachment end 14 of the cartridge. When the cartridge 90 is connected to the control body 80, the plug 65 engages the receptacle 60 to form an electrical connection such that current controllably flows from the battery 40, through the receptacle and plug, and to the resistive heating element 50. The cartridge shell 91 can continue across the distal attachment end such that this end of the cartridge is substantially closed with the plug protruding therefrom. As illustrated in FIG. 1, the plug 65 includes an open central passage that aligns with the open central passage in the receptacle 60 to allow air to flow from the control body 80 and into the cartridge 90.

Generally, in use, when a consumer draws on the mouthend 11 of the cartridge, the flow sensor 30 detects the change in flow and activates the control component 20 to facilitate current flow through the resistive heating element 50. Thus, it is useful for air flow to travel through the control body 80 in a manner that flow sensor 30 detects air flow almost instantaneously.

The control algorithm may call for power to the resistive heating element 50 to cycle and thus maintain a defined temperature. The control algorithm therefore can be programmed to automatically deactivate the smoking article 10 and discontinue power flow through the smoking article after a defined time lapse without a puff by a consumer. Moreover, the smoking article can include a temperature sensor to provide feedback to the control component. Such sensor can be, for example, in direct contact with the resistive heating element 50. Alternative temperature sensing means likewise may be used, such as relying upon logic control components to evaluate resistance through the resistive heating element and correlate such resistance to the temperature of the element. In other embodiments, the flow sensor 30 may be replaced by appropriate components to provide alternative sensing means, such as capacitive sensing. Still further, one or more control buttons can be included to allow for manual actuation by a consumer to elicit a variety of functions, such as powering the article 10 on and off, turning on the heating element 50 to generate a vapor or aerosol for inhalation, or the like.

When the flow sensor 30 is positioned within the control body 80, it can be useful to have an air intake 17 on the control body. If desired, a sealed flow path can be provided such that the flow sensor 30 within the control body 80 is in fluid connection with the cartridge interior after the cartridge and the control body are engaged, such fluid connection being sealed with respect to the remainder of the components within the control body but opening into the cartridge 90 when attached to the control body. Further, in other embodiments, the flow sensor 30 can be located within the cartridge 90 instead of the control body 80.

A reservoir may utilize a transport element to transport an aerosol precursor composition to an aerosolization zone. As used herein, the term “reservoir” refers to a receptacle or chamber for holding, storing, or retaining a product such as a liquid, fluid, or aerosol. One such example is shown in FIG. 1. As seen therein, the cartridge 90 includes a reservoir layer 201 comprising layers of nonwoven fibers formed into the shape of a tube encircling the interior of the cartridge shell 91, in this embodiment. An aerosol precursor composition is retained in the reservoir layer 201. Liquid components, for example, can be sorptively retained by the reservoir layer 201. The reservoir layer 201 is in fluid connection with a transport element 301 (a wick in this embodiment). The transport element 301 transports the aerosol precursor composition stored in the reservoir layer 201 via capillary action to an aerosolization zone 400 of the cartridge 90. As illustrated, the transport element 301 is in direct contact with the resistive heating element 50 that is in the form of a metal wire coil in this embodiment.

In use, when a user draws on the article 10, the resistive heating element 50 is activated (e.g., such as via a puff sensor), and the components for the aerosol precursor composition are

vaporized in the aerosolization zone 400. Drawing upon the mouthend 11 of the article 10 causes ambient air to enter the air intake 17 and pass through the central opening in the receptacle 60 and the central opening in the plug 65. In the cartridge 90, the drawn air passes through an air passage 230 in an air passage tube 220 and combines with the formed vapor in the aerosolization zone 400 to form an aerosol. The aerosol is whisked away from the aerosolization zone, passes through an air passage 260 in an air passage tube 250, and out the mouth opening 18 in the mouthend 11 of the article 10. If desired, the air passage tube 250 can be absent, and an open cavity may reside in the location for formation of aerosol as the aerosol precursor composition is vaporized by the resistive heating element 50.

The smoking article 10 in the embodiment illustrated in FIG. 1 can be characterized as a disposable article. Accordingly, it can be desirable for the reservoir 201 in such embodiments to include a sufficient amount of aerosol precursor composition and any further inhalable materials so that a consumer can obtain more than a single use of the smoking article. For example, the smoking article can include sufficient aerosolizable and/or inhalable materials such that the smoking article can provide a number of puffs substantially equivalent to the number of puffs (of about two seconds duration) available from a plurality of conventional cigarettes – e.g., 2 or more, 5 or more, 10 or more, or 20 or more conventional cigarettes. More particularly, a disposable, single unit article according to the embodiment of FIG. 1 can provide about 20 or more, about 50 or more, or about 100 or more puffs.

Although FIG. 1 is illustrative of a smoking article according to the present disclosure, the scope of the disclosure should not be viewed as being limited to the specific combination and/or arrangement of components illustrated therein. Rather, the present disclosure can encompass a variety of combinations of components useful in forming an electronic smoking article. Reference is made for example to the smoking articles disclosed in US Pat. Pub. No. 2014/0000638 to Sebastian et al., and US Pat. Pub. No. 2013/0255702 to Griffith, Jr., et al., the disclosures of which are incorporated herein by reference in their entirety. Further to the above, representative heating element and materials for use therein are described in US Pat. No. 5,060,671 to Counts et al.; US Pat. No. 5,093,894 to Deevi et al.; 5,224,498 to Deevi et al.; 5,228,460 to Sprinkel Jr., et al.; 5,322,075 to Deevi et al.; US Pat. No. 5,353,813 to Deevi et al.; US Pat. No. 5,468,936 to Deevi et al.; US Pat. No. 5,498,850 to Das; US Pat. No. 5,659,656 to Das; US Pat. No. 5,498,855 to Deevi et al.; US Pat. No. 5,530,225 to Hajaligol; US Pat. No. 5,665,262 to Hajaligol; US Pat. No. 5,573,692 to Das et al.; and US Pat. No. 5,591,368 to Fleischhauer et al., the disclosures of which are incorporated herein by reference in their entirety.

The various components of a smoking article according to the present invention can be chosen from components described in the art and commercially available. Examples of batteries that can be used according to the disclosure are described in US Pub. App. No. 2010/0028766, the disclosure of which is incorporated herein by reference in its entirety.

An exemplary mechanism that can provide puff-actuation capability includes a Model 163PC01D36 silicon sensor, manufactured by the MicroSwitch division of Honeywell, Inc., Freeport, Ill. Further examples of demand-operated electrical switches that may be employed in a heating circuit according to the present disclosure are described in US Pat. No. 4,735,217 to Gerth et al., which is incorporated herein by reference in its entirety. Further description of current regulating circuits and other control components, including microcontrollers, that can be useful in the present smoking article are provided in US Pat. Nos. 4,922,901, 4,947,874, and 4,947,875, all to Brooks et al., US Pat. No. 5,372,148 to McCafferty et al., US Pat. No. 6,040,560 to Fleischhauer et al., and US Pat. No. 7,040,314 to Nguyen et al., all of which are incorporated herein by reference in their entireties.

The aerosol precursor composition, or vapor precursor composition, can comprise one or more different components. For example, the aerosol precursor can include a polyhydric alcohol (e.g., glycerin, propylene glycol, or a mixture thereof). Representative types of further aerosol precursor compositions are set forth in US Pat. No. 4,793,365 to Sensabaugh, Jr. et al.; US Pat. No. 5,101,839 to Jakob et al.; PCT WO 98/57556 to Biggs et al.; and Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco, R. J. Reynolds Tobacco Company Monograph (1988); the disclosures of which are incorporated herein by reference.

Aerosol precursor compositions can include further liquid materials, such as water. For example, aerosol precursor compositions can incorporate mixtures of glycerin and water, or mixtures of propylene glycol and water, or mixtures of propylene glycol and glycerin, or mixtures of propylene glycol, glycerin, and water. Exemplary aerosol precursor compositions also include those types of materials incorporated within devices available through Atlanta Imports Inc., Acworth, Ga., USA., as an electronic cigar having the brand name E-CIG, which can be employed using associated Smoking Cartridges Type C1a, C2a, C3a, C4a, C1b, C2b, C3b and C4b; and as Ruyan Atomizing Electronic Pipe and Ruyan Atomizing Electronic Cigarette from Ruyan SBT Technology and Development Co., Ltd., Beijing, China. Exemplary formulations for aerosol precursor compositions that may be used according to the present disclosure are described in U.S. Pat. Pub. No. 2013/0008457 to Zheng et al., the disclosure of which is incorporated herein by reference in its entirety.

The aerosol precursor composition used in the disclosed smoking article further can comprise one or more flavors, medicaments, or other inhalable materials. For example, liquid nicotine can be used. Such further materials can comprise one or more components of the aerosol precursor or vapor precursor composition. Thus, the aerosol precursor or vapor precursor composition can be described as comprising an inhalable substance. Such inhalable substance can include flavors, medicaments, and other materials as discussed herein. Particularly, an inhalable substance delivered using a smoking article according to the present invention can comprise a tobacco component or a tobacco-derived material. Alternately, the flavor, medicament, or other inhalable material can be provided separate from other aerosol precursor components – e.g., in a reservoir. As such, defined aliquots of the flavor, medicament, or other inhalable material may be separately or simultaneously delivered to the resistive heating element to release the flavor, medicament, or other inhalable material into an air stream to be inhaled by a user along with the further components of the aerosol precursor or vapor precursor composition.

A wide variety of types of flavoring agents, or materials that alter the sensory or organoleptic character or nature of the mainstream aerosol of the smoking article, can be employed. Such flavoring agents can be provided from sources other than tobacco, can be natural or artificial in nature, and can be employed as concentrates or flavor packages. Of particular interest are flavoring agents that are applied to, or incorporated within, those regions of the smoking article where aerosol is generated. Again, such agents can be supplied directly to the resistive heating element or may be provided on a substrate as already noted above. Exemplary flavoring agents include vanillin, ethyl vanillin, cream, tea, coffee, fruit (e.g., apple, cherry, strawberry, peach and citrus flavors, including lime and lemon), maple, menthol, mint, peppermint, spearmint, wintergreen, nutmeg, clove, lavender, cardamom, ginger, honey, anise, sage, cinnamon, sandalwood, jasmine, cascarilla, cocoa, licorice, and flavorings and flavor packages of the type and character traditionally used for the flavoring of cigarette, cigar, and pipe tobaccos. Syrups, such as high fructose corn syrup, also can be employed. Flavoring agents also can include acidic or basic characteristics (e.g., organic acids, such as levulinic acid, succinic acid, lactic acid, and pyruvic acid). The flavoring agents can be combined with the aerosol-generating material if desired. Exemplary plant-derived compositions that may be used are disclosed in US Pat. Pub. No. 2012/0152265 to Dube et al. and US Pat. Pub. No. 2012/0192880 to Dube et al., the disclosures of which are incorporated herein by reference in their entireties.

Organic acids particularly may be incorporated into the aerosol precursor to provide desirable alterations to the flavor, sensation, or organoleptic properties of medicaments, such as nicotine, that may be combined with the aerosol precursor. For example, organic acids, such as

levulinic acid, succinic acid, lactic acid, and pyruvic acid, may be included in the aerosol precursor with nicotine in amounts up to being equimolar (based on total organic acid content) with the nicotine. Any combination of organic acids can be used. For example, the aerosol precursor can include about 0.1 to about 0.5 moles of levulinic acid per one mole of nicotine, about 0.1 to about 0.5 moles of pyruvic acid per one mole of nicotine, about 0.1 to about 0.5 moles of lactic acid per one mole of nicotine, or combinations thereof, up to a concentration wherein the total amount of organic acid present is equimolar to the total amount of nicotine present in the aerosol precursor.

In embodiments of the aerosol precursor material that contain a tobacco extract, including pharmaceutical grade nicotine derived from tobacco, it is advantageous for the tobacco extract to be characterized as substantially free of compounds collectively known as Hoffmann analytes, including, for example, tobacco-specific nitrosamines (TSNAs), including N'-nitrosonornicotine (NNN), (4-methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N'-nitrosoanatabine (NAT), and N'-nitrosoanabasine (NAB); polyaromatic hydrocarbons (PAHs), including benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene, and the like. In certain embodiments, the aerosol precursor material can be characterized as completely free of any Hoffmann analytes, including TSNAs and PAHs.

Embodiments of the aerosol precursor material may have TSNA levels (or other Hoffmann analyte levels) in the range of less than about 5 ppm, less than about 3 ppm, less than about 1 ppm, or less than about 0.1 ppm, or even below any detectable limit. Certain extraction processes or treatment processes can be used to achieve reductions in Hoffmann analyte concentration. For example, a tobacco extract can be brought into contact with an imprinted polymer or non-imprinted polymer such as described, for example, in US Pat. Pub. Nos. 2007/0186940 to Bhattacharyya et al.; 2011/0041859 to Rees et al.; and 2011/0159160 to Jonsson et al.; and US Pat. Appl. No. 13/111,330 to Byrd et al., filed May 19, 2011, all of which are incorporated herein by reference. The tobacco extract may be treated with ion exchange materials having amine functionality, which can remove certain aldehydes and other compounds. See, for example, US Pat. Nos. 4,033,361 to Horsewell et al. and 6,779,529 to Figlar et al., which are incorporated herein by reference in their entireties.

In certain embodiments, the aerosol precursor can be adapted to increase in surface area during heating for aerosol formation in an electronic smoking article. The aerosol precursor can comprise an effervescent material, which can be adapted to degrade during heating and release carbon dioxide (or other gaseous substance) sufficient to cause foaming of at least a portion of the aerosol precursor or to produce fine droplets. Inclusion of such effervescent can be beneficial to reduce the amount of heat needed to form an aerosol from the aerosol precursor.

The aerosol precursor composition may take on a variety of conformations based upon the various amounts of materials utilized therein. For example, a useful aerosol precursor composition may comprise up to about 98% by weight up to about 95% by weight, or up to about 90% by weight of a polyol. This total amount can be split in any combination between two or more different polyols. For example, one polyol can comprise about 50% to about 90%, about 60% to about 90%, or about 75% to about 90% by weight of the aerosol precursor, and a second polyol can comprise about 2% to about 45%, about 2% to about 25%, or about 2% to about 10% by weight of the aerosol precursor. A useful aerosol precursor also can comprise up to about 25% by weight, about 20% by weight or about 15% by weight water – particularly about 2% to about 25%, about 5% to about 20%, or about 7% to about 15% by weight water. Flavors and the like (which can include medicaments, such as nicotine) can comprise up to about 10%, up to about 8%, or up to about 5% by weight of the aerosol precursor.

As a non-limiting example, an aerosol precursor according to the invention can comprise glycerol, propylene glycol, water, nicotine, and one or more flavors. Specifically, the glycerol can be present in an amount of about 70% to about 90% by weight, about 70% to about 85% by weight, or about 75% to about 85% by weight, the propylene glycol can be present in an amount of about 1% to about 10% by weight, about 1% to about 8% by weight, or about 2% to about 6% by weight, the water can be present in an amount of about 10% to about 20% by weight, about 10% to about 18% by weight, or about 12% to about 16% by weight, the nicotine can be present in an amount of about 0.1% to about 5% by weight, about 0.5% to about 4% by weight, or about 1% to about 3% by weight, and the flavors can be present in an amount of up to about 5% by weight, up to about 3% by weight, or up to about 1% by weight, all amounts being based on the total weight of the aerosol precursor. One specific, non-limiting example of an aerosol precursor comprises about 75% to about 80% by weight glycerol, about 13% to about 15% by weight water, about 4% to about 6% by weight propylene glycol, about 2% to about 3% by weight nicotine, and about 0.1% to about 0.5% by weight flavors. The nicotine, for example, can be from a tobacco extract.

The amount of aerosol precursor composition that is used within the smoking article is such that the article exhibits acceptable sensory and organoleptic properties, and desirable performance characteristics. For example, it is highly preferred that sufficient aerosol precursor composition components, such as glycerin and/or propylene glycol, be employed in order to provide for the generation of a visible mainstream aerosol that in many regards resembles the appearance of tobacco smoke. Typically, the amount of aerosol-generating material incorporated into the smoking article is in the range of about 1.5 g or less, about 1 g or less, or about 0.5 g or less. The amount of aerosol precursor composition can be dependent upon factors such as the number of

puffs desired per cartridge used with the smoking article. It is desirable for the aerosol precursor composition not to introduce significant degrees of unacceptable off-taste, filmy mouth-feel, or an overall sensory experience that is significantly different from that of a traditional type of cigarette that generates mainstream smoke by burning tobacco cut filler. The selection of the particular aerosol-generating material and reservoir material, the amounts of those components used, and the types of tobacco material used, can be altered in order to control the overall chemical composition of the mainstream aerosol produced by the smoking article.

Still further components can be utilized in the smoking article of the present disclosure. For example, US 5,261,424 to Sprinkel, Jr. discloses piezoelectric sensors that can be associated with the mouth-end of a device to detect user lip activity associated with taking a draw and then trigger heating; US 5,372,148 to McCafferty et al. discloses a puff sensor for controlling energy flow into a heating load array in response to pressure drop through a mouthpiece; US 5,967,148 to Harris et al. discloses receptacles in a smoking device that include an identifier that detects a non-uniformity in infrared transmissivity of an inserted component and a controller that executes a detection routine as the component is inserted into the receptacle; US 6,040,560 to Fleischhauer et al. describes a defined executable power cycle with multiple differential phases; US 5,934,289 to Watkins et al. discloses photonic-optronic components; US 5,954,979 to Counts et al. discloses means for altering draw resistance through a smoking device; US 6,803,545 to Blake et al. discloses specific battery configurations for use in smoking devices; US 7,293,565 to Griffen et al. discloses various charging systems for use with smoking devices; US 2009/0320863 by Fernando et al. discloses computer interfacing means for smoking devices to facilitate charging and allow computer control of the device; US 2010/0163063 by Fernando et al. discloses identification systems for smoking devices; and WO 2010/003480 by Flick discloses a fluid flow sensing system indicative of a puff in an aerosol generating system; all of the foregoing disclosures being incorporated herein by reference in their entireties. Further examples of components related to electronic aerosol delivery articles and disclosing materials or components that may be used in the present article include US Pat. No. 4,735,217 to Gerth et al.; US Pat. No. 5,249,586 to Morgan et al.; US Pat. No. 5,666,977 to Higgins et al.; US Pat. No. 6,053,176 to Adams et al.; US 6,164,287 to White; US Pat No. 6,196,218 to Voges; US Pat. No. 6,810,883 to Felter et al.; US Pat. No. 6,854,461 to Nichols; US Pat. No. 7,832,410 to Hon; US Pat. No. 7,513,253 to Kobayashi; US Pat. No. 7,896,006 to Hamano; US Pat. No. 6,772,756 to Shayan; US Pat. Pub. Nos. 2009/0095311, 2006/0196518, 2009/0126745, and 2009/0188490 to Hon; US Pat. Pub. No. 2009/0272379 to Thorens et al.; US Pat. Pub. Nos. 2009/0260641 and 2009/0260642 to Monsees et al.; US Pat. Pub. Nos. 2008/0149118 and 2010/0024834 to Oglesby et al.; US Pat. Pub. No. 2010/0307518 to Wang; US Pat. Pub. No.

2013/0037041 to Worm et al.; and WO 2010/091593 to Hon. A variety of the materials disclosed by the foregoing documents may be incorporated into the present devices in various embodiments, and all of the foregoing disclosures are incorporated herein by reference in their entireties.

Although an article according to the disclosure may take on a variety of embodiments, as discussed in detail below, the use of the article by a consumer will be similar in scope. In particular, the article can be provided as a single unit or as a plurality of components that are combined by the consumer for use and then are dismantled by the consumer thereafter. Generally, a smoking article according to the disclosure can comprise a first unit that is engagable and disengagable with a second unit, the first unit comprising the resistive heating element, and the second unit comprising the electrical power source. In some embodiments, the second unit further can comprise one or more control components that actuate or regulate current flow from the electrical power source. The first unit can comprise a distal end that engages the second unit and an opposing, proximate end that includes a mouthpiece (or simply the mouthend) with an opening at a proximate end thereof. The first unit can comprise an air flow path opening into the mouthpiece of the first unit, and the air flow path can provide for passage of aerosol formed from the resistive heating element into the mouthpiece. In preferred embodiments, the first unit can be disposable. Likewise, the second unit can be reusable.

During use, the consumer initiates heating of the resistive heating element, the heat produced by the resistive heating element aerosolizes the aerosol precursor composition and, optionally, further inhalable substances. Such heating releases at least a portion of the aerosol precursor composition in the form of an aerosol (which can include any further inhalable substances included therewith), and such aerosol is provided within a space inside the cartridge that is in fluid communication with the mouthend of the cartridge. When the consumer inhales on the mouth end of the cartridge, air is drawn through the cartridge, and the combination of the drawn air and the aerosol is inhaled by the consumer as the drawn materials exit the mouth end of the cartridge (and any optional mouthpiece present) into the mouth of the consumer. To initiate heating, the consumer may actuate a pushbutton, capacitive sensor, or similar component that causes the resistive heating element to receive electrical energy from the battery or other energy source (such as a capacitor). The electrical energy may be supplied for a pre-determined length of time or may be manually controlled. Preferably, flow of electrical energy does not substantially proceed in between puffs on the article (although energy flow may proceed to maintain a baseline temperature greater than ambient temperature – e.g., a temperature that facilitates rapid heating to the active heating temperature). In further embodiments, heating may be initiated by the puffing action of the consumer through use of various sensors, as otherwise described herein. Once the

puff is discontinued, heating will stop or be reduced. When the consumer has taken a sufficient number of puffs so as to have released a sufficient amount of the inhalable substance (e.g., an amount sufficient to equate to a typical smoking experience), the cartridge can be removed from the control housing and discarded. Indication that the cartridge is spent (i.e., the aerosol precursor composition has been substantially removed by the consumer) can be provided. In some embodiments, a single cartridge can provide more than a single smoking experience and thus may provide a sufficient content of aerosol precursor composition to simulate as much as full pack of conventional cigarettes or even more.

The foregoing description of use of the article can be applied to the various embodiments described through minor modifications, which can be apparent to the person of skill in the art in light of the further disclosure provided herein. The above description of use, however, is not intended to limit the use of the article but is provided to comply with all necessary requirements of disclosure of the present disclosure.

In various embodiments, the present disclosure particularly can provide a reservoir that can be easily combined with further elements of a smoking article, particularly a cartridge. For example, FIG. 2 provides a cut-away view of a cartridge 500 that can be included in an electronic smoking article. The cartridge 500 includes a reservoir 501 according to one embodiment. The cartridge 500 can be substantially tubular in shape and can be formed of a reservoir wall 502 as described herein. As illustrated, the reservoir 501 can be in the general shape of a substantially hollow tube that is concentric with the cartridge wall 502. The reservoir 501 can be substantially rod-like or substantially tubular shaped or substantially cylindrically shaped. Thus, the reservoir 501 can have a diameter such that the reservoir 501 can be adapted to fit within the cartridge 500. The reservoir 501 can be formed from a plurality of combined layers that can be concentric or overlapping. For example, the reservoir 501 can be a continuous sheet of material that is rolled to form the hollow tube. The reservoir also may be a mat of nonwoven material. In other embodiments, the reservoir 501 can be substantially a unitary component. For example, the reservoir 501 can be shaped or molded so as to be a singular element in the form of a substantially hollow tube that is substantially continuous in composition across the length and thickness thereof. The reservoir 501 can be rigid or semi-rigid. The reservoir 501 can include a first end 503 and an opposing second end 504. The reservoir 501 includes an exterior surface 505 that can be substantially shaped and adapted to conform to an interior surface 506 of cartridge wall 502. If desired, one or more additional components of a smoking article according to the present disclosure can be accommodated within or around the reservoir 501. While the reservoir 501 is shown in the cartridge 500 portion of a smoking article in FIG. 2, one skilled in the art will appreciate that the

reservoir 501 can be positioned within any portion of a smoking article so as not to impede the storage and delivery of an aerosol precursor composition stored therein.

In certain embodiments, a reservoir according to the present disclosure can be provided in a form such that at least part of the hollow interior thereof is shaped and dimensioned to accommodate one or more further components of the smoking article. In some embodiments, the term “shaped and dimensioned” can indicate that a wall of the hollow interior includes one or more indentations or protrusions that cause the interior to have a shape that is other than substantially smooth and continuous. In other embodiments, the hollow nature of the reservoir can be sufficient to allow for accommodation of further components of the smoking article without the need for formation of cavities or protrusions.

The articles of the present disclosure can be particularly beneficial in that the reservoir can be pre-formed and can have a hollow interior with a wall that is shaped and dimensioned to accommodate a further component of the smoking article in a mating arrangement. This particularly can facilitate ease of assembly of the smoking article and can maximize the reservoir volume while also providing sufficient space for aerosol formation. One embodiment of a cartridge according to the present disclosure is shown in FIG. 3, which provides an exploded view of a cartridge 500. As seen therein, a cartridge wall 502 can be adapted to enclose a reservoir 501 as described herein. The exterior surface 505 of the reservoir 501 can be adapted to conform to the interior surface 506 of the cartridge wall 502.

The reservoir 501 also has an inner surface 508 that defines a central cavity 507 of the reservoir. In the illustrated embodiment, the inner surface 508 of the reservoir 501 includes two diametrically opposed grooves (515, 516) that extend inward into the reservoir from the central cavity. As illustrated, the grooves extend substantially the entire length of the reservoir 501 from the first end 503 to the second end 504 thereof. In other embodiments, the grooves may be absent, and the inner surface of the reservoir still may be characterized as being shaped and dimensioned to accommodate an atomizer in that the atomizer can be positioned with the central cavity such that a portion of the atomizer is in fluid connection with the reservoir.

In the embodiment of FIG. 3, the atomizer specifically comprises a heater, a liquid transport element, and electrically conducting terminals. As illustrated in FIG. 3, the liquid transport element is a continuous, elongated wick 509, and the heater is a resistive heating coil 510 that is in connection with the wick and is positioned at about a midpoint of the wick. The portions of the wick extending beyond the resistive heating coil can be referred to as distal arms of the wick. The electrically conducting terminals 511 of the atomizer 520 are positioned in contact with the wick 509 distal to the resistive heating coil 510. The electrically conducting terminals particularly can

be characterized as being in contact with the wick at one or more portions of the wick distal to the resistive heating coil. As illustrated, the electrically conducting terminals 511 extend beyond the ends of the wick 509. Such extension is not necessarily required. In light of the nature of the reservoir 501 with its hollow interior portion, an atomizer can be easily positioned interior to the reservoir during assembly of the smoking article. Likewise, as the hollow interior can be shaped and dimensioned to mate with the atomizer, the combination can be easily assembled, and the atomizer can snugly mate with the reservoir while simultaneously placing the wick in fluid connection with the reservoir.

The above configuration is further illustrated in FIG. 4, which provides a perspective view of a reservoir 501 according one embodiment having an atomizer 520 combined therewith. The reservoir 501 includes a central cavity 507 that can be devoid of fibrous material and capable of storing, holding, or retaining a product such as an aerosol precursor composition. The atomizer 520 is combined with the reservoir 501 in that the distal arms of the wick 509 are mated with and engaging the diametrically opposed grooves (515, 516). The grooves may be pre-formed in the reservoir or the grooves may be formed by the engagement of the atomizer wick with the inner walls of the reservoir such that the fibrous reservoir is locally compressed by the atomizer wick. By adapting the inner surface 508 of the central cavity 507 of the reservoir 501 to accommodate the various smoking article components, available open space in the smoking article can be fully maximized by extending the reservoir 501 into the previously open spaces. As a result, the overall size and capacity of the reservoir 501 can be increased in comparison to traditional woven or non-woven fiber mats that are typically utilized in electronic smoking articles. The increased capacity allows the reservoir 501 to hold an increased amount of aerosol precursor composition which, in turn, results in longer use and enjoyment of the smoking article by the end user.

As illustrated in FIG. 4, the portion of the atomizer 520 comprising the resistive heating element extends beyond the second end 504 of the reservoir 501. When assembled with a cartridge, the second end 504 of the reservoir 501 can be positioned proximate to a mouthend (see element 11 in FIG. 1) of the cartridge. Desirably, the mouthend of the cartridge can include an open cavity wherein aerosol can be formed as the aerosol precursor composition is vaporized by the resistive heating element. In other embodiments, it is not necessary for the atomizer to extend beyond the end of the reservoir, and the atomizer can be positioned relative to the reservoir such that the resistive heating element is within the hollow cavity of the reservoir.

The reservoir can be manufactured from any material capable of being shaped into a rigid or semi-rigid hollow tube while retaining the ability to store a liquid product such as, for example, an aerosol precursor composition. In certain embodiments, the reservoir material can be absorbent,

adsorbent, or otherwise porous so as to provide the ability to retain the aerosol precursor composition. As such, the aerosol precursor composition can be characterized as being coated on, adsorbed by, or absorbed in the reservoir material. The reservoir can be positioned within the smoking article to be in substantial contact with one or more transport elements (e.g., wicks). More particularly, a reservoir can be manufactured from any material suitable for retaining the aerosol precursor composition (e.g., through absorption, adsorption, or the like) and allowing wicking away of the precursor composition for transport to the resistive heating element.

The reservoir material is suitable for forming and maintaining an appropriate conformation, such as a substantially tubular shape, and for accommodating therein the suitable components of the smoking article. The reservoir material can be heat resistant so as to retain its structural integrity – e.g., does not degrade – at least at a temperature that is received in a position proximal to the heating temperature provided by the resistive heating element. The size and strength of the reservoir may vary according to the features and requirements of the corresponding electronic smoking article. In some embodiments, the reservoir can be manufactured from a material suitable for a high-speed, automated manufacturing process. In certain embodiments, the reservoir can comprise a woven or non-woven fibrous mat, which may be rolled or otherwise formed into a tube or hollow cylinder shape. In other embodiments, the reservoir can be a molded tube or hollow cylinder.

According to one embodiment, the reservoir can be manufactured from a cellulose acetate tow which can be processed to form a hollow acetate tube. Cellulose acetate tow can be prepared according to various processes known to one skilled in the art. See, for example, the processes forth in US Pat. No. 4,439,605 to Yabune, US Pat No. 5,167,764 to Nielsen et al., and US Pat No. 6,803,458 to Ozaki which are incorporated herein by reference in their entireties. Typically, cellulose acetate is derived from cellulose by reacting purified cellulose from wood pulp with acetic acid and acetic anhydride in the presence of sulfuric acid. The resulting product is then put through a controlled, partial hydrolysis to remove the sulfate and a sufficient number of acetate groups to produce the required properties for a cellulose acetate that is capable of ultimately forming a rigid or semi-rigid hollow tube. Cellulose acetate can then be extruded, spun, and arranged into a tow. The cellulose acetate fibers can be opened, crimped, or a continuous filament.

In further embodiments, the cellulose acetate can be any acetate material of the type that can be employed for providing a tobacco smoke filter for cigarettes. A traditional cigarette filter material can be used, such as cellulose acetate tow, gathered cellulose acetate web, or gathered cellulose acetate web. Examples of materials that can be used as an alternative to cellulose acetate include polypropylene tow, gathered paper, strands of reconstituted tobacco, or the like. One filter

material that can provide a suitable filter rod and thus a suitable hollow tube reservoir is cellulose acetate tow having 3 denier per filament and 40,000 total denier. As another example, cellulose acetate tow having 3 denier per filament and 35,000 total denier can be used. As another example, cellulose acetate tow having 8 denier per filament and 40,000 total denier can be used. Further examples include the types of filter materials set forth in U.S. Pat. No. 3,424,172 to Neurath; U.S. Pat. No. 4,811,745 to Cohen et al.; U.S. Pat. No. 4,925,602 to Hill et al.; U.S. Pat. No. 5,225,277 to Takegawa et al. and U.S. Pat. No. 5,271,419 to Arzonico et al.; each of which is incorporated herein by reference.

Cellulose acetate fibers can be mixed with other materials, such as, cellulose, viscose, cotton, cellulose acetate-butyrate, cellulose propionate, polyester – e.g., polyethylene terephthalate (PET), polylactic acid (PLA), activated carbon, glass fibers, metal fibers, wood fibers, and the like. The fibers of a cellulose acetate tow emerging from the spinneret can be bunched together to form a “raw tow” which can be collected into a bale for subsequent processing into a tube as described herein. Additional examples of fiber materials that can be suitable for use in a reservoir according to the present disclosure are described in US Pat Publication No. 2013/0025610 to Sebastian et al., the disclosure of which is incorporated herein by reference.

Cellulose acetate can be processed and formed into a tube using conventional filter tow processing means. For example, a steam bonding process can be used to produce the hollow acetate tubes. Exemplary processes for forming tubes of cellulose acetate can be found US Pat. Publication No. 2012/0255569 to Beard et al. In further embodiments, cellulose acetate can be processed using a conventional filter tow processing unit. For example, filter tow can be bloomed using bussel jet methodologies or threaded roll methodologies. An exemplary tow processing unit has been commercially available as E-60 supplied by Arjay Equipment Corp., Winston-Salem, N.C. Other exemplary tow processing units have been commercially available as AF-2, AF-3 and AF-4 from Hauni-Werke Korber & Co. KG. and as Candor-ITM Tow Processor from International Tobacco Machinery. Other types of commercially available tow processing equipment, as are known to those of ordinary skill in the art, can be employed. Alternative materials for forming the hollow tube reservoir, such as gathered paper, nonwoven polypropylene web, or gathered strands of shredded web, can be provided using the types of materials, equipment and techniques set forth in U.S. Pat. No. 4,807,809 to Pryor et al. and U.S. Pat. No. 5,025,814 to Raker. In addition, representative manners and methods for operating a filter material supply units and filter-making units are set forth in U.S. Pat. No. 4,281,671 to Bynre; U.S. Pat. No. 4,850,301 to Green, Jr. et al.; U.S. Pat. No. 4,862,905 to Green, Jr. et al.; U.S. Pat. No. 5,060,664 to Siems et al.; U.S. Pat. No. 5,387,285 to Rivers and U.S. Pat. No. 7,074,170 to Lanier, Jr. et al.

The hollow acetate tubes as described herein can be particularly useful because of a surprisingly efficient liquid storing capacity. According to one embodiment, the cellulose acetate tow can have a linear mass density of about 0.5 denier per filament (dpf) or greater, about 1 dpf or greater, or about 2 dpf or greater. In other embodiments, the cellulose acetate tow can have a linear mass density of about 0.5 dpf to about 20 dpf, about 0.75 dpf to about 15 dpf, about 1 dpf to about 10 dpf, or about 2 dpf to about 6 dpf. The cellulose acetate used according to the present disclosure can comprise staple fibers. The staple fibers can have an average length of about 0.1 in. to about 6 in., about 0.2 in. to about 5 in. or about 0.25 in. to about 3 in.

The reservoir comprising cellulose acetate can be formed of various compositions and in various manners. In particular embodiments, the reservoir can comprise cellulose acetate fibers. If desired, the reservoir can comprise a binder. Fillers (e.g., cellulose) and fibers formed of different materials also can be used. The reservoir can comprise about 70% to about 99% by weight cellulose acetate fibers, and the weights noted herein are measured on a dry weight basis. More specifically, the reservoir can comprise about 75% to about 98%, about 80% to about 97.5%, or about 90% to about 97% by weight cellulose acetate fibers. The reservoir can comprise about 1% to about 30% by weight of the binder. More specifically, the reservoir can comprise about 2% to about 25%, about 2.5% to about 20%, or about 3% to about 10% by weight of the binder. In specific embodiments, a reservoir according to the disclosure can comprise about 95% to about 97% by weight cellulose acetate fiber and about 3% to about 5% by weight binder. In other specific embodiments, a reservoir according to the disclosure can comprise about 80% to about 85% by weight cellulose acetate fiber and about 15% to about 20% by weight binder. A binder is understood to be a material that imparts a cohesive effect to the fibers used in forming the disclosed reservoirs. For example, the binder can be a material that partially solubilizes the cellulose acetate fibers such that the fibers bind to each other or to further fibrous materials included in the woven or non-woven reservoir. Exemplary binders that can be used include polyvinyl acetate (PVA) binders, starch, and triacetin. One of skill in the art of cigarette filter manufacture may recognize triacetin as being a plasticizer for such filters. As such, it is understood that there may be overlap between the group of binders useful according to the present disclosure and materials that may be recognized in further arts as plasticizers. Accordingly, the cohesion agent used and described herein as a binder may encompass materials that may be recognized in other fields as being plasticizers. Moreover, materials recognized in the field of cigarette filters as plasticizers for cellulose acetate may be encompassed by the use of the term binders herein.

The cellulose acetate fibers can have various cross-sectional shapes – e.g., round, elongated, or multi-lobal. In specific embodiments, cellulose acetate having a tri-lobal or Y-shaped cross-sectional shape can be used.

In some embodiments, a non-woven fibrous mat reservoir according to the present disclosure can be formed by a wet-laid process or by a dry-laid process. When using a wet-laid process, it can be beneficial to use cellulose acetate fibers having shorter lengths – e.g., in the range of about 0.25 in. to about 2 in. When using a dry-laid process, it can be beneficial to use cellulose acetate fibers having longer lengths – e.g., in the range of about 2.5 in. to about 3 in. In each case, a resulting mat comprising the cellulose acetate fibers can be at a thickness of about 1 mm to about 4 mm, about 1.25 mm to about 3.5 mm, or about 1.5 mm to about 3 mm. The cellulose acetate mat can have a basis weight of about 70 grams per square meter (gsm) to about 240 gsm, about 80 gsm to about 220 gsm, or about 90 gsm to about 200 gsm. The cellulose acetate mat can be sized to a desired width. In various embodiments, the width can be about 10 mm to about 25 mm, about 15 mm to about 24 mm, or about 20 mm to about 23 mm. The cellulose acetate mats can be cut to lengths suitable to be rolled into a tube having an outer diameter suitable for insertion into a smoking article as described herein and having an inner diameter suitable to allow insertion of an atomizer therein according to the present disclosure. The ends of the rolled mats can form a butt joint or may overlap. In further embodiments, the cellulose acetate composition can be molded into a formed shape that is substantially tubular. The shaped hollow acetate tube can have one or more shapes formed into the inner wall thereof, such as the diametrically opposed grooves discussed above.

In some embodiments, the fibers of the formed mats can be entangled. For example, hydroentangling and needle punching each can be used separately or in combination. In specific embodiments, needle punching can be used with at least 250, at least 500, at least 1,000, or at least 1,500 needle punches per square inch (NPPSI). In particular, about 250 to about 2,500, about 500 to about 2,000, or about 750 to about 1,500 NPPSI can be used.

According to one embodiment, the reservoir can comprise a mixture of different types of fibers. Suitable fibers for forming such mixture include, but are not limited to, fibers formed from cellulose acetate, wood pulp, wool, silk, polyesters (e.g., polyethylene terephthalate) polyamides (e.g., nylons), polyolefins, polyvinyl alcohol, and the like.

It has been found according to the present disclosure that hydrophilic fibers, particularly cellulose acetate, can be particularly useful in forming a reservoir for an aerosol precursor composition, particularly a composition formed predominately with a polyhydric alcohol, such as glycerin. Such reservoirs can provide improved storage and release of the aerosol precursor

composition. For example, such reservoirs can provide for faster loading of the aerosol precursor composition, for more consistent release of the aerosol precursor composition when drawn away, such as by a wick, during use of the smoking article, and a reduction in the total volume of aerosol precursor composition that must be loaded in the reservoir.

The filaments used in a wick according to the present disclosure can be formed of any material that provides sufficient wicking action to transport one or more components of the aerosol precursor composition along the length of the filament. Non-limiting examples include natural and synthetic fibers, such as cotton, cellulose, polyesters, polyamides, polylactic acids, glass fibers, combinations thereof, and the like. Other exemplary materials that can be used in wicks include metals, ceramics, and carbonized filaments (e.g., a material formed of a carbonaceous material that has undergone calcining to drive off non-carbon components of the material).

The filaments (or the wick generally) can be coated with materials that alter the capillary action of the filaments – i.e., to increase (or decrease, if desired) the wicking action of the filament. Also, fiber material selection can be utilized to increase or decrease wicking action and thus control the wicking rate of a specific component of the aerosol precursor composition. Wicking also can be customized through choice of the dimensions of the fibers used in the wicks and the overall dimensions of the wick, including wick length and wick diameter.

The filaments used in forming wicks can have specific cross-sectional shape and/or can be grooved so as to alter the capillary action of the fibers. Filaments can have a substantially round cross-section, and altering fiber cross-section shape can increase the surface area per denier of the fiber and thus improve wicking along the filament. For example, a filament can be formed with longitudinal grooves that are intended to facilitate wicking, such as a 4DG fiber (available from Fiber Innovation Technology) and winged fibers (available from Alasso Industries). Filaments formed with an “X” or “Y” shaped cross-section similarly can provide desirable wicking properties.

In other embodiments, at least a portion of a filament utilized in a wick can be designed to promote radial wicking. Continuous filament fibers, such as fiberglass, tend to promote wicking primarily along the axis of the filament – i.e., axial wicking. Through appropriate design, the filament also can be caused to promote radial wicking – i.e., outward from the axis of the filament. For example, radial wicking can be facilitated through use of filaments having a fibrillated fiber surface. Such design particularly can be useful in the area of the filaments that are in proximity to or in contact with the heater as it can cause more of the precursor composition to be available for aerosolization in the specific area of the heater. Similarly particles or beads can be sintered or otherwise interconnected to provide a continuous wick structure with a like effect.

Filaments used in forming wicks can be provided singly or can be bundled (including meshes and braids). A filament can be a single fiber, or a filament can be formed of a group of combined fibers that provide a larger mass. Porosity of the filaments used in the wick also can be controlled to alter the capillary action and can include controlling average pore size and total porosity, controlling filament geometry, controlling overall wick shape, and controlling surface characteristics. Separate filaments also can have different lengths. Varying the nature of the filaments can be useful to customize vapor formation. For example, filaments with greater wicking ability can be used to transport a component of an aerosol precursor composition that is to be vaporized in a high amount, and filaments with a reduced wicking ability can be used to transport a component of an aerosol precursor composition that is desired to be vaporized in a lesser amount.

The type of material used to form the individual filaments of the wicks also can be customized to transport specific types of compounds. For example, one or more wicks can be formed of filaments utilizing hydrophobic materials so as to preferentially wick hydrophobic liquids. Further, one or more wicks can be formed of filaments utilizing hydrophilic materials so as to preferentially wick hydrophilic liquids. Moreover, one or more wicks can include filaments formed of materials that are neither hydrophilic nor hydrophobic, such as natural materials, so as to preferentially wick liquids that are neither significantly polar nor significantly non-polar.

In particular embodiments, a wick useful as the liquid transport component is a braided wick. The braided wick can be formed from at least 3 separate fibers or yarns. Further, the braided wick can be formed from at least 4, at least 6, at least 8, at least 10, at least 12, at least 14, or at least 16 separate fibers or yarns. Each of the separate fibers or yarns may be identical in composition. Alternatively, the separate fibers or yarns may comprise fibers or yarns formed of two or more different compositions (e.g., a fiberglass yarn braided with a cotton yarn). Thus, the braided wick can be formed of a plurality of synthetic fibers or yarns, a plurality of natural fibers or yarns, of a combination of at least one synthetic fiber or yarn and at least one natural fiber or yarn. In certain embodiments, E-glass can be used. In preferred embodiments, C-glass can be used. Use of C-glass has been determined to be of particular use because of the higher solubility of the material in lung fluid compared to other materials, particularly other fiberglass materials.

A braided wick in particular may be provided as a component of a sheath/core yarn. In particular, a first wick material can form a yarn core, and a second wick material can surround the core to form a yarn sheath. The sheath and core can differ in at least one of physical structure and the material from which the yarn is formed. In a preferred example, a twisted yarn can comprise the core, and braided yarn can form the sheath.

An example of a sheath/core wick according to some embodiments of the disclosure is shown in the cross-section of FIG. 5 where a sheath/core wick 202 can be formed of a sheath component 203 and a core component 204. The sheath 203 is formed of braided fibers or yarn, as otherwise described herein. The core 204 is formed of a non-braided yarn. In some embodiments, the relative dimensions of the sheath/core wick cross-section can vary. The core may be in direct contact with the sheath, or a space may be provided between the sheath and the core.

A method of making an electronic smoking article is provided. The method includes the step of providing a cylinder comprising cellulose acetate and having a hollow interior portion. At least part of the hollow interior can be shaped and dimensioned to accommodate one or more further components of the smoking article. The method can further include the step of inserting an atomizer into the hollow interior of the cellulose acetate cylinder. The atomizer can comprise a liquid transport element, a heater, and electrical contacts. The method can further include the steps of inserting the cylinder and atomizer into a hollow shell, and connecting the atomizer to a power source. The power source can be a battery. Portions of the liquid transport element can be attached to or embedded in the reservoir to form a fluid connection that enables transport of the aerosol precursor composition out of the reservoir. The atomizer can comprise a continuous, elongated wick having two opposing ends. The wick particularly can be a braided wick and can comprise C-glass. The atomizer can further comprise a heater in connection with the wick and positioned at about a midpoint thereof. The atomizer also can comprise electrically conducting terminals positioned in physical contact with the wick and in electrical contact with the heater. According to one embodiment, the heater can be a resistive heating element. In some embodiments, the step of inserting the atomizer into the cellulose acetate cylinder can comprise extending a portion of the atomizer beyond an end of the cellulose acetate cylinder.

EXPERIMENTAL

The presently disclosed subject matter is more fully illustrated by the following examples, which are set forth to illustrate the presently disclosed subject matter and provide full disclosure, and they are not to be construed as limiting thereof.

EXAMPLE 1

Preparation of Cellulose Acetate Reservoirs

Drylaid cellulose acetate (CA) substrates were constructed from conventional cigarette filter tow (Eastman Estron acetate tow, 3.0 dpf, 40,000 total denier, Y cross section) chopped to a staple length of 2.5 in. for evaluation of suitability for use as a reservoir according to the present

disclosure. The sheet was mechanically entangled in a needlepunch process. There were no additional fibers or binders added to the sheet. Other CA fiber and tow sizes can be used, as well as various fiber cross sections, and staple lengths compatible with carding/needling. Needling at 500, 1000, and 1500 needle punches per square inch (NPPSI) all produced a usable sheet. The finished substrate sheets were produced from about 70 gsm to about 240 gsm, which yielded thicknesses from about 1 mm to about 4 mm. A preferred embodiment had a basis weight of 150 gsm at about 2 mm thickness and 1000 NPPSI. The lighter basis weight substrates resulted in greater amounts of aerosol generated from the product, all other factors being equal. These sheet parameters were chosen in part to accommodate the needs of the cartridge design and assembly process. They can be adjusted to match larger or smaller liquid loadings and/or physical cartridge size.

Hydroentangling was also tested as a method of entangling the staple fibers to create a cohesive sheet. Other methods such as stitch bonding, ultrasonic, or thermal bonding can also be used. Triacetin or other plasticizers, or a sprayed bonding agent might also be used. Mixtures of fibers can also be used to adjust the sheet properties with regard to liquid affinity, wicking, strength, elongation, and stiffness.

Wetlaid CA substrates were constructed from non-crimped CA yarns produced by Celanese and Eastman Chemical. The Eastman yarn was specified at 4.0 dpf and 150 total denier, regular (round) cross-section, with a conventional cigarette tow finish. The yarns were cut to 0.25 in. and 0.5 in. lengths for use in the wetlaid process. The 0.5 in. cut was preferred in the testing due to increased sheet integrity. Longer staple lengths may also improve this. Other filament deniers, total deniers, or cross-sections also can be used.

Several sheet compositions were tested. All compositions used a majority of CA fiber from about 75% to about 92% of the total dry weight. Additional fibers (singly or mixed) were added to strengthen the sheet from about 8% to about 25% of the total dry weight. These included: HP-11 wood pulp from Buckeye Technologies; DPL-2607, a PET (polyethylene terephthalate) bicomponent fiber, from Fiber Innovation Technologies; and Kuralon VPB 105-2x4, PVOH (polyvinyl alcohol) fiber from Kuraray Co., Ltd. The final material selected for production had a composition of 92% CA, 4% wood pulp, and 4% PVOH.

The finished substrate sheets were produced from about 70 gsm to about 160 gsm, with thicknesses from about 0.7 mm to about 3 mm. An exemplary material was about 115 gsm and about 1.5 mm thick. These sheet parameters were chosen in part to accommodate the needs of the cartridge design and assembly process. They can be adjusted to match larger or smaller liquid loadings and/or physical cartridge size. The substrate sheets were useful for formation into a hollow tube reservoir.

Other cellulosic fibers including rayon or cotton can be used in place of, or in addition to, wood pulp for substantially the same effect. Other methods of binding the sheet can include spray binders such as latex or solvent bonding with triacetin or other plasticizers.

An advantage to the wetlaid process is the ability to adjust fiber orientation to alter the “squareness” of the sheet. This works to reduce machine direction elongation, which in turn can improve the slit width uniformity.

EXAMPLE 2

Improved Uptake and Release of Aerosol Precursor Composition

Reservoirs in known aerosolization devices typically have been formed of a nonwoven mat of polyester (PET) fibers. This has the advantage of being a relatively cheap and widely available material; however, it has been found that the hydrophobic nature of the material can lead to disadvantages, particularly when an aerosol precursor composition is formed primarily of hydrophilic materials. For example, PET nonwoven sheets promote little or no movement of the liquid precursor composition and can take on the order of several hours for full movement of a liquid precursor composition through the entire reservoir.

Experiments were conducted to evaluate cellulose acetate (CA) based substrates as reservoirs. A drylaid, nonwoven cellulose acetate reservoir (100% CA, 2.5 in. average fiber length, 150 gsm weight) was compared to a PET reservoir of like dimensions. FIG. 6 shows the two reservoirs one minute after placing the dry reservoirs on a liquid substrate comprising glycerin. FIG. 7 shows the reservoirs two minutes after placement. At one minute the CA tube had absorbed significant amounts of liquid while the PET had little to no absorption. At two minutes, the CA tube was saturated while the PET tube still had little to no absorption. This higher affinity for the liquid affects the product in multiple ways. For manufacturing, it allows rapid filling of the cartridge with the substrate absorbing liquid more readily and evenly. For product use, it permits the liquid in the cartridge to migrate more easily to the wick making more efficient use of the liquid in the cartridge.

The CA substrate was also tested against the PET substrate to evaluate filling times when used as a reservoir in a cartridge for a smoking article. The filling time for the PET substrate when applying liquid at the top of the substrate in the cartridge was greater than 30 minutes. The filling time under the same conditions for the CA substrate was less than two minutes.

With PET based substrates, it has been frequently observed at the end of product life that regions of the substrate not in contact with the wick are still saturated with liquid while the substrate in contact with the wick has become depleted. This is an inefficient system because more

liquid must be put in the cartridge than can be effectively converted to aerosol. The images in FIG. 8 and FIG. 9 show a CA substrate before use (FIG. 8) and after use (FIG. 9). The figures show that when a CA reservoir is used in a smoking article, the applied aerosol precursor composition is depleted evenly throughout the reservoir. This advantageously can allow for the use of both a smaller reservoir and a smaller volume of aerosol precursor composition to achieve a desired number of puffs on a smoking article incorporating the CA reservoir. As seen in FIG. 10, aerosol forming efficiency increased as the size of the reservoir (saturated with aerosol precursor composition) decreased indicating that the aerosol precursor composition is efficiently and evenly transferred from the reservoir for aerosolization.

EXAMPLE 3

Improved Uptake and Release of Liquid Transport Component

One of the major deficiencies identified with many known aerosolization smoking articles is the change in aerosol delivery over the life of the article. Most articles decline from 25% to 60% in aerosol delivery when comparing initial performance (e.g., puffs 1-20) to end-of-life performance (e.g., puffs 180-200). Ideally, the performance would be consistent over the life of the product. Testing was carried out to evaluate improving performance based on the nature of the liquid transport component (i.e., the wick) in the smoking article.

A comparative wick was formed of a twisted fiberglass yarn (9 micron E-glass) having a diameter of approximately 0.054 in. and a linear mass of about 2.15 mg/mm. The twisted yarn exhibited little cohesive structure, especially when cut to short lengths. The yarn was easily compressed which was considered a disadvantage for maintaining good contact with the resistive wire heater. When cut, the ends of the yarn were prone to blooming open as the tension or torsion imparted in the twisting process was released. This was expected to decrease the effectiveness of the wick for fluid transport.

In order to address these physical deficiencies, a braided fiberglass wick was developed at approximately the same specifications: 9-micron E-glass, 0.052 in. diameter, 2.47 mg/mm linear mass. This braided wick performed similarly to the original twisted wick. In both designs, the average mg of total particulate matter (TPM) per puff decreased by about 25% from the initial puffs to the end-of life puffs. This is illustrated in FIG. 11.

In a further test, a braided wick sheath was formed around a twisted core. The diameter and mass of the wick were also reduced. Three sheath/core wicks were formed with diameters of 0.043 in. to 0.047 in. and linear masses of 1.65 mg/mm to 1.85 mg/mm. The braided exterior of the sheath/core wicks were formed using 8 bobbins, 12 bobbins, and 16 bobbins, respectively, and thus

were characterized as comprising 8, 12, or 16 braids. Each of the three sheath/core wicks provided a significantly higher TPM yield. See FIG. 12. The sheath/core wicks also exhibited smaller changes in TPM over the product life declining by about 20% in two cases. Compared to the original twisted wick, all of the braided designs exhibited greater physical integrity when cut with little unraveling or fraying. The braided designs were also firmer, potentially improving contact between the wire heater and the braid.

Many modifications and other embodiments of the disclosure will come to mind to one skilled in the art to which this disclosure pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the disclosure is not to be limited to the specific embodiments disclosed herein and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS:

1. An electronic smoking article comprising:
an electrical power source; and
a reservoir that comprises cellulose acetate and is configured to hold an aerosol precursor material.
2. The electronic smoking article of claim 1, wherein the reservoir is substantially shaped as a cylinder having a hollow interior portion, and optionally wherein at least part of the hollow interior is shaped and dimensioned to accommodate one or more further components of the smoking article.
3. The electronic smoking article of claim 2, wherein the one or more further components is an atomizer comprising one or both of a heater and a liquid transport element.
4. The electronic smoking article of claim 3, wherein the liquid transport element is a continuous, elongated article adapted for wicking a liquid.
5. The electronic smoking article of claim 3, wherein the liquid transport element comprises a braided wick.
6. The electronic smoking article of claim 5, wherein the liquid transport element is in the form of a sheath/core wick.
7. The electronic smoking article of claim 6, wherein the sheath portion of the wick is braided.
8. The electronic smoking article of claim 7, wherein the core portion of the wick is non-braided or is formed of a different material than the braided sheath, or both.
9. The electronic smoking article of claim 5, wherein the braided wick is a braid of at least 4 separate fibers or yarns.

10. The electronic smoking article of claim 3, wherein the liquid transport element comprises fiberglass, which optionally is C-glass.
11. The electronic smoking article of claim 2, wherein the hollow interior comprises a central cavity with diametrically opposed grooves extending into the reservoir, and wherein the grooves are adapted to mate with portions of an atomizer.
12. The electronic smoking article of claim 1, wherein the cellulose acetate fiber has a linear mass density of about 0.5 dpf or greater.
13. The electronic smoking article of claim 1, wherein the reservoir comprises about 70% to about 99% by weight cellulose acetate and about 2% to about 25% by weight of a binder.
14. The electronic smoking article of claim 2, further comprising an atomizer positioned within the hollow interior portion of the reservoir, the atomizer comprising:
a continuous, elongated wick having two opposing ends;
a heater in connection with the wick and positioned at about a midpoint thereof; and
electrically conducting terminals positioned in physical contact with the wick and in electrical connection with the heater.
15. An electronic smoking article comprising:
a reservoir with a liquid aerosol precursor composition stored therein; and
a braided wick in fluid communication with the reservoir.
16. The electronic smoking article of claim 15, wherein the braided wick is a sheath/core wick.
17. The electronic smoking article of claim 16, wherein the braided wick is the sheath and surrounds the core.
18. The electronic smoking article of claim 17, wherein the core is one or more of:
non-braided;
formed of a different material than the braided sheath; and
formed of a twisted yarn.

19. The electronic smoking article of claim 15, wherein the braided wick is a braid of at least 4 separate fibers or yarns.

20. The electronic smoking article of claim 15, wherein the braided wick comprises fiberglass that is C-glass or E-glass.

21. The electronic smoking article of claim 15, wherein the reservoir comprises cellulose acetate.

22. A cartridge for an electronic smoking article, the cartridge comprising an atomizer at least partially positioned within a hollow interior of a tube-shaped reservoir adapted for holding an aerosol precursor composition, the reservoir tube being positioned within a hollow shell, wherein the atomizer comprises:

a continuous, elongated wick having two opposing ends;

a heater in connection with the wick and positioned at about a midpoint thereof; and
electrically conducting terminals; and

wherein the reservoir tube is formed of cellulose acetate, the wick is a braided wick, or both.

23. The cartridge of claim 22, wherein the hollow shell comprises a first end adapted to engage a control component and an opposing mouthend, and wherein the heater of the atomizer extends out of the reservoir tube in a cavity formed at the mouthend of the hollow shell.

24. The cartridge of claim 22, wherein the braided wick is a sheath/core wick.

25. The cartridge of claim 24, wherein the braided wick is the sheath and surrounds the core.

26. The cartridge of claim 25, wherein the core is non-braided or is formed of a different material than the braided sheath, or both.

27. The cartridge of claim 22, wherein the braided wick is a braid of at least 4 separate fibers or yarns.

28. The cartridge of claim 22, wherein the wick comprises fiberglass that is C-glass or E-glass.

29. A method of making an electronic smoking article, the method comprising:
providing a cylinder comprising cellulose acetate and having a hollow interior portion; and
inserting an atomizer into the hollow interior of the cellulose acetate cylinder.

30. The method of claim 29, further comprising:
inserting the cylinder and atomizer into a hollow shell; and
connecting the atomizer to a power source.

31. The method of claim 30, wherein the atomizer comprises a continuous, elongated wick having two opposing ends and a heater in connection with the wick and positioned at about a midpoint thereof.

32. The method of claim 30, wherein said inserting comprises extending a portion of the atomizer beyond an end of the cellulose acetate cylinder.

33. A wick suitable for use in an electronic smoking article, the wick comprising a braid of at least 4 separate fibers or yarns, at least one of which is C-glass or E-glass.

34. The wick of claim 33, wherein the braided wick is a sheath/core wick.

35. The wick of claim 34, wherein the braided wick is the sheath and surrounds the core.

36. The wick of claim 34, wherein the core is one or more of:
non-braided;
formed of a different material than the braided sheath; and
formed of a twisted yarn.

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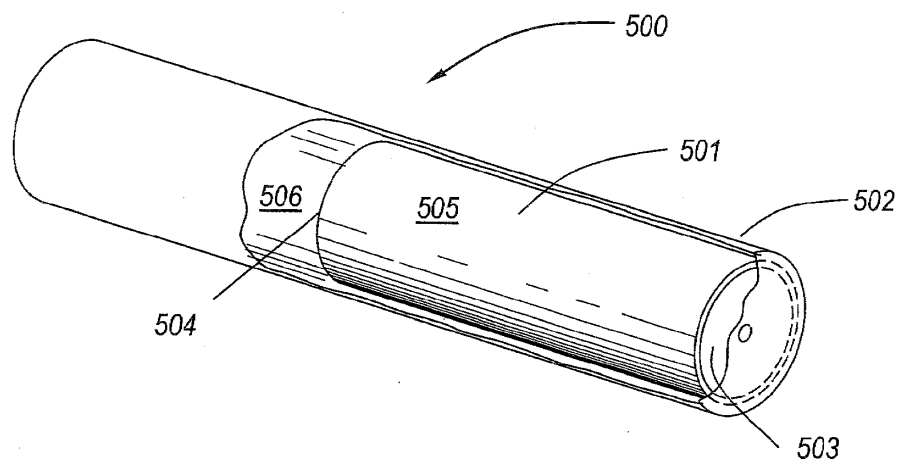


Fig. 2

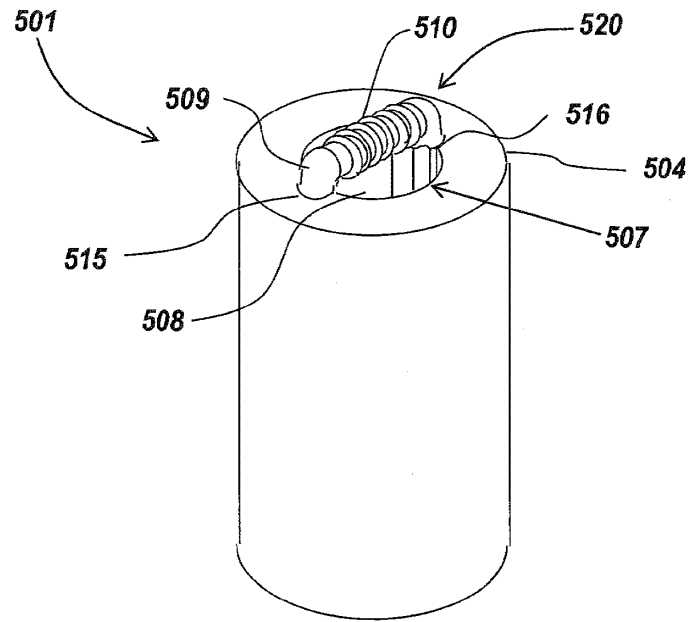


Fig. 4

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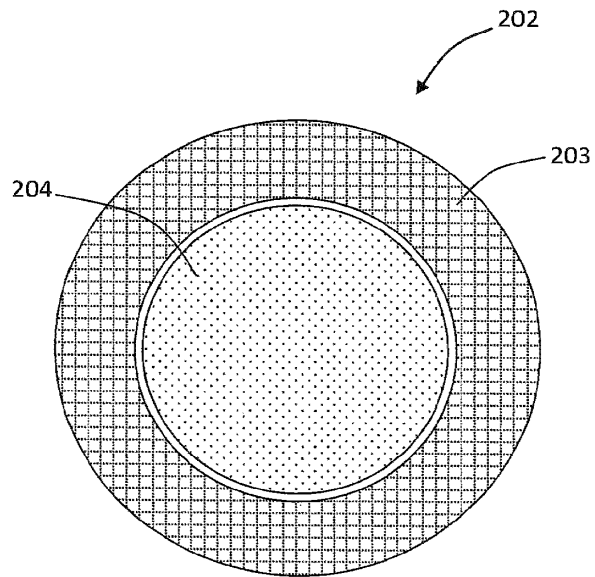


Fig. 5

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Fig. 6



Fig. 7

SUBSTITUTE SHEET (RULE 26)

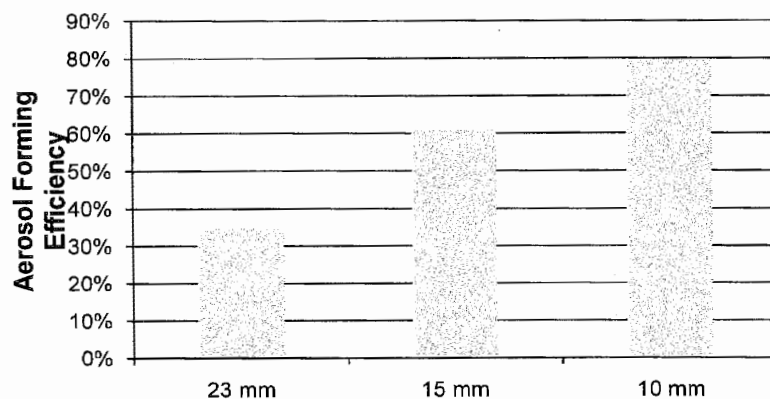
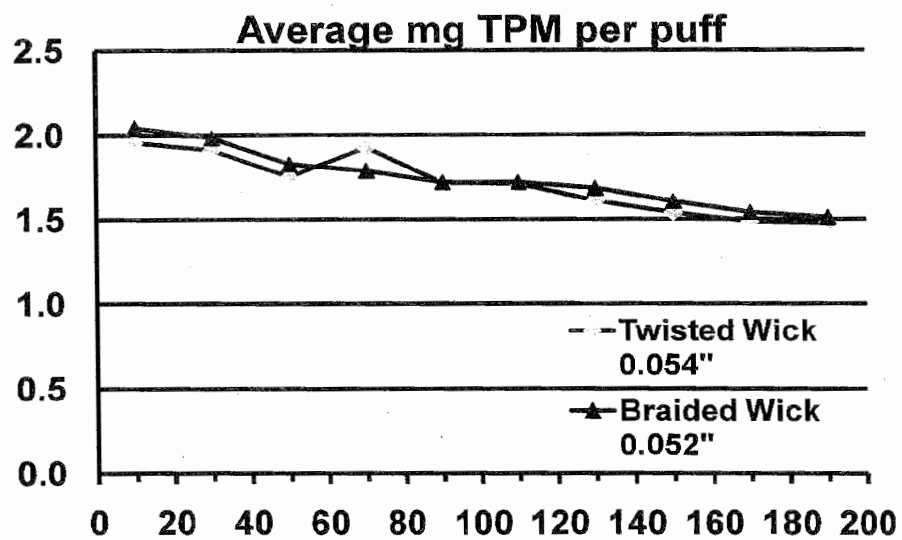
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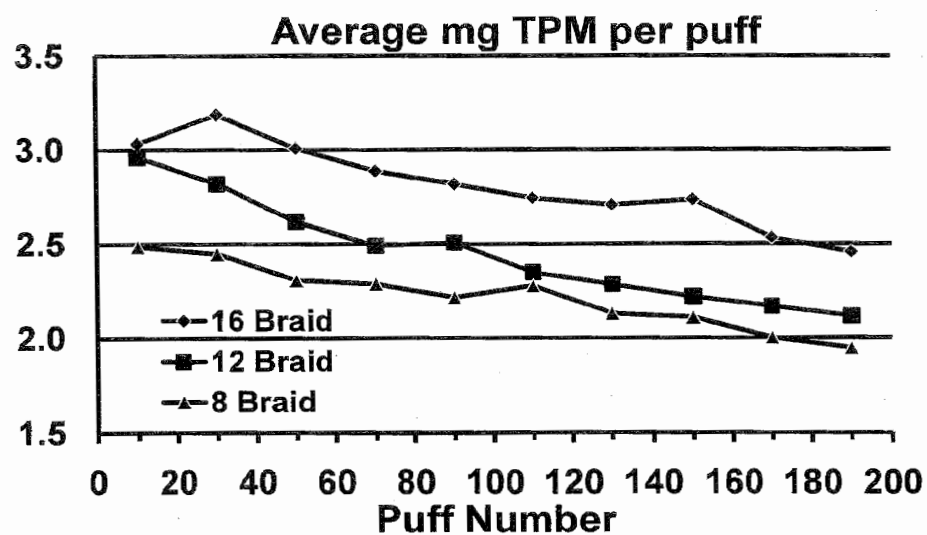


Fig. 8



Fig. 9

**Fig. 10****Fig. 11**

**Fig. 12**

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/025565

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 358 114 A2 (REYNOLDS TOBACCO CO R [US]) 14 March 1990 (1990-03-14) the whole document -----	1-14, 29-32 22-28
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☒ Further documents are listed in the continuation of Box C.

☒ 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

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 August 2014

Date of mailing of the international search report

25/08/2014

Name and mailing address of the ISA/

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Authorized officer

Cardan, Cosmin

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/025565

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/025565

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14, 29-32

the subject-matter of the first group of inventions refers
to a improved reservoir for an electronic cigarette

2. claims: 15-21, 33-36

the subject-matter of the second group of inventions refers
to an improved wick for an electronic cigarette

3. claims: 22-28

the subject-matter of the third group of inventions refers
to a cartridge for an electronic cigarette

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/025565

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Information on patent family members

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(54) Title: ELECTRONIC SMOKING ARTICLE WITH ALTERNATIVE AIR FLOW PATHS

(57) Abstract: An apparatus and method of controlling resistance-to-draw of an electronic smoking article is disclosed, which includes a reusable portion and a cartomizer portion, and which includes: supplying an air flow from one or more inlets in an outer cylindrical housing of the electronic smoking article to a cartomizer via a cartomizer inlet having a fixed diameter configured to control a resistance-to-draw of the electronic smoking article and wherein the cartomizer inlet is located inside the outer cylindrical housing of the electronic smoking article, wherein a combined air flow area of the one or more inlets in the outer housing of the electronic smoking article are greater than a cross-sectional area of the cartomizer inlet; heating a liquid material from a reservoir to form an aerosol; and combining the at least initially volatilized liquid material with the air flow from the cartomizer inlet.



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ELECTRONIC SMOKING ARTICLE WITH ALTERNATIVE AIR FLOW PATHS**RELATED APPLICATION(S)**

[0001] The present application claims priority under 35 U.S.C. 119 to U.S. Provisional Patent Application No. 61/857,931, filed on July 24, 2013, the entire content of which is hereby incorporated by reference.

WORKING ENVIRONMENT

[0002] Electronic smoking articles.

SUMMARY

[0003] In accordance with an exemplary embodiment, an electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprises: an outer cylindrical housing extending in a longitudinal direction, the outer cylindrical housing having one or more inlets configured to allow air to be drawn into the smoking article; a power source; a cartomizer, which includes: a reservoir; a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol; and a gasket in fluid communication with the one or more inlets and configured to provide a seal with an interior surface of the outer cylindrical housing and having a central, longitudinal air passage configured to provide resistance-to-draw (RTD) to the smoking article, and wherein a combined air flow area of the one or more inlets of the outer cylindrical housing is greater than a cross-sectional area of the longitudinal air passage of the gasket; a condensation chamber in communication with an outlet on a downstream end of the cartomizer; and a mouth-end insert.

[0004] In accordance with an exemplary embodiment, an electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprises: a reusable portion housing a power source and circuitry; a cartomizer portion housing a cartomizer, which includes: a reservoir; and a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol; a condensation chamber in communication with an outlet on a downstream end of the air flow channel; and a mouth-end insert; and a connector configured to connect the reusable portion to the

cartomizer portion, and wherein the connector has a plurality of circumferentially spaced apart slots, which is in fluid communication with one or more cartomizer holes, and wherein the one or more cartomizer holes are configured to provide a source of air flow to the heater and wick arrangement of the cartomizer, and wherein a combined air flow area of the plurality of circumferentially spaced apart slots is greater than a combined cross-sectional area of the one or more cartomizer holes.

[0005] In accordance with an exemplary embodiment, an electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprises: a reusable portion housing a power source and circuitry; a cartomizer portion housing a cartomizer, which includes: a reservoir; and a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol; a condensation chamber in communication with an outlet on a downstream end of the air flow channel; and a mouth-end insert; and at least one vent hole positioned in the reusable portion of the smoking article between a downstream end of the power source and the cartomizer portion, and wherein the at least one vent hole is in fluid communication with a flow control insert located on an upstream end of an air flow channel of the cartomizer, the flow control insert having at least one cartomizer inlet configured to control an amount of air flow to the cartomizer, and wherein an air flow area of the at least one vent hole is greater than an air flow area of the at least one cartomizer inlet.

[0006] In accordance with an exemplary embodiment, a method of controlling resistance-to-draw of an electronic smoking article, which includes a reusable portion and a cartomizer portion, comprises: supplying an air flow from one or more inlets in an outer cylindrical housing of the smoking article to a cartomizer via a cartomizer inlet having a fixed diameter configured to control a resistance-to-draw of the smoking article and wherein the cartomizer inlet is located inside the outer cylindrical housing of the electronic smoking article, and wherein a combined air flow area of the one or more inlets in the outer housing of the smoking article is greater than a cross-sectional area of the cartomizer inlet; heating a liquid material from a reservoir to form an aerosol in a central air channel; combining the at least initially volatilized liquid material with the air flow from the cartomizer inlet; and condensing the saturated vapor within the condensation chamber in communication with the air flow channel to form the aerosol.

[0007] In accordance with an exemplary embodiment, a method of establishing a common, predetermined RTD consistently amongst a plurality of electronic smoking articles includes: for each electronic smoking article, establishing an airflow path within said electronic smoking article and including at a location along said airflow path a passage through a resilient gasket; and for each smoking article, determining an RTD by disposing a common, rigid tubular member at a location along said passageway, said tubular member having an inner diameter that establishes said common, predetermined RTD in said smoking article.

[0008] The electronic smoking article can also include a mouth-end insert in fluid communication with the condensation chamber so as to deliver aerosol to a smoker (or vaper).

[0009] As used herein, the term “electronic smoking article” is inclusive of all types of electronic smoking articles, regardless of form, size or shape, including electronic cigarettes, electronic cigars, electronic pipes, electronic hookahs and the like. The liquid aerosol formulation can include nicotine or be nicotine free. Moreover, the liquid aerosol formulation can include tobacco flavors or instead, or in combination include other suitable flavors

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The accompanying figures are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The figures illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

[0011] FIG. 1 is a cross-section view of an electronic smoking article in accordance with an exemplary embodiment.

[0012] FIG. 2 is a perspective view of the cartomizer section of an electronic smoking article with and without the outer housing according to an exemplary embodiment.

[0013] FIG. 3 is a perspective view of an electronic smoking article in accordance with an exemplary embodiment.

[0014] FIG. 4 is a perspective view of the connector as shown in FIG. 3.

[0015] FIG. 5 is a perspective view of an electronic smoking article having a connector as shown in FIG. 3 in accordance with an exemplary embodiment.

[0016] FIG. 6 is another perspective view of an electronic smoking article having a connector as shown in FIG. 3 in accordance with an exemplary embodiment.

[0017] FIG. 7 is a perspective view of an electrical smoking article in accordance with an exemplary embodiment.

[0018] FIG. 8 is a perspective view of a flow control insert of the smoking article as shown in FIG. 7 in accordance with an exemplary embodiment.

[0019] FIG. 9 is a perspective view of the flow control insert as shown in FIG. 7 in accordance with an exemplary embodiment.

[0020] FIG. 10 is a cross-sectional side view of the gasket of the electronic smoking article of FIG. 2.

DETAILED DESCRIPTION

[0021] In an electronic smoking article 100, the difference between the pressure of the incoming and outgoing air can be referred to as the resistance-to-draw (RTD) of the article 100. For example, the resistance-to-draw is the resistance offered by the electronic smoking article 100, as the smoker (or vaper) draws on the article. Having an article's resistance-to-draw (RTD) within an appropriate range can be important for delivering a good smoker experience. For example, the factors that define the RTD of an electronic smoking article 100 can include the resistance offered to the airflow by the geometry of the article 100 and the flow rate at which air is drawn into the article 100. While the flow rate can be controlled by the smoker, the geometry design of the article 100 can be used to achieve a targeted RTD range and regulate which hole(s) or passage(s) within the article 100 can control the RTD of the article 100.

[0022] In some electronic smoking article designs, if a smoker or consumer inadvertently blocks one or both of the air vent holes (or cartomizer holes) partially or completely, this can result in an increase in the RTD of the article 100. Accordingly, it would be desirable to provide an electronic smoking article 100, wherein the hole(s) or passage(s), which control the resistance-to-draw (RTD), are inside the electronic smoking article 100 as disclosed herein. In addition, it would be desirable

to have an electronic smoking article 100 that is configured such that if the smoker and/or consumers blocks or obstructs one or more of the air vent holes with his or her fingers, the blockage or obstruction of the one or more air vent holes will not significantly influence the resistance-to-draw (RTD).

[0023] In accordance with exemplary embodiments, as shown in FIGS. 1-9, the resistance-to-draw (RTD) can be located inside the electronic smoking article in such a way that the airflow is not impacted by the usage behavior of the consumer, for example, how the smoker and/or consumer holds the electronic smoking article. In accordance with an exemplary embodiment, an electronic smoking article is disclosed having a gasket with a central, longitudinal air passage having a fixed diameter (or hole size), which can be configured to control a desired resistance-to-draw (RTD) of the electronic smoking article. In addition, by controlling the desired resistance-to-draw from within the electronic smoking article, the size of the one or more inlets or vent holes in the outer housing become less critical, such that the resistance-to-draw of the electronic smoking article 100 is not impacted by the usage behavior of the consumer, for example, how he or she handles the electronic smoking article.

[0024] FIG. 1 is a cross-sectional view of a schematic diagram of an electronic smoking article 100, such as an electronic cigarette according to an exemplary embodiment. As shown in FIG. 1, the electronic smoking article 100 comprises a reusable fixture (or first section) 110, and a replaceable cartomizer section (or second section) 120, which are coupled together at a threaded joint (not shown) or by other convenience such as a snug-fit, snap-fit, detent, clamp and/or clasp.

[0025] In accordance with an exemplary embodiment, the first section 110 can house a power supply 112 and control circuitry 114. In accordance with an exemplary embodiment, the replaceable cartomizer section 120 includes a connector portion 130, a cartomizer 140, a condensation chamber 150, and a mouth-end insert 160.

[0026] The reusable fixture 110 and the cartomizer section 120 have a generally cylindrical outer housing 102 extending in a longitudinal direction along the length of the electronic smoking article 100. In accordance with an exemplary embodiment, the electronic smoking article 100 is formed so that the diameter of the electronic

cigarette is substantially uniform along the length thereof. In accordance with an exemplary embodiment, the outer cylindrical housing 102 is substantially continuous along the length thereof and can be rigid.

[0027] In accordance with an exemplary embodiment, a pressure activated switch (not shown) can be positioned on an outer surface of the outer cylindrical housing 102, which acts to activate a heater. By applying manual pressure to the pressure switch, the power supply is activated and an electric current heats a liquid or liquid material 144 in the cartomizer 140 via electrical contacts so as to volatilize the liquid material 144. For example, a depression (not shown) can be formed in the outer cylindrical housing 102 to indicate where the smoker or consumer should apply pressure. The depression can extend fully or partially about the circumference of the outer cylindrical housing 102.

[0028] In accordance with an exemplary embodiment, the power supply 112 is activated upon application of manual pressure to the pressure switch and the cartomizer 140 is heated to form a heated section wherein the liquid material 144 within a fluid reservoir (or liquid supply region) 142 is volatilized. Upon discharge from a central air flow channel 180, the volatilized material expands, mixes with air and forms an aerosol.

[0029] In accordance with an exemplary embodiment, the cartomizer section 120 includes the reservoir 142 including a liquid material 144 and a heater and wick arrangement 170 in fluid communication with the reservoir 142, such that the wick arrangement 170 draws or wicks the liquid material 144 from the reservoir 142 and heats the liquid material 144 to form an aerosol in a central air channel 180. The cartomizer section 120 includes an outer tube (or housing) 104 extending in a longitudinal direction and an inner tube (or chimney) 200 coaxially positioned within the outer tube 104.

[0030] In an exemplary embodiment, the power supply 112 is operable to apply voltage across a heater and wick arrangement 170 associated with the cartomizer 140 and volatilizes the liquid material 144 contained therein according to a power cycle of either a predetermined time period, such as a 5 second period, or for so long as the pressure activated switch is pressed. The heater and wick arrangement 170 can include a heater 172 and a filamentary wick 174.

[0031] In use, for example, liquid material 144 is transferred from the reservoir 142 in proximity of the heater and wick arrangement 170 by capillary action of the filamentary wick 174. In an embodiment, the filamentary wick 174 has a first end portion and a second end portion, wherein the first end and the second end extend into opposite sides of the reservoir for contact with liquid material contained therein. Also preferably, the heater 172 at least partially surrounds a central portion of the filamentary wick 174 such that when the heater 172 is activated, the liquid in the central portion of the filamentary wick 174 is vaporized by the heater 172 to form an aerosol.

[0032] The filamentary wick 174 preferably comprises filaments having a capacity to draw a liquid, more preferably a bundle of glass (or ceramic) filaments and most preferably a bundle comprising a group of windings of glass filaments, preferably three of such windings, all which arrangements are capable of drawing liquid via capillary action via interstitial spacings between the filaments. Alternatively, in place of the filamentary wick 174, a heated capillary or capillary tube (not shown) can be used, which volatilizes a liquid such as by way of the teachings set forth in US Patent 5,743,251, which is incorporated herein in its entirety by reference thereto.

[0033] In accordance with an exemplary embodiment, the inner tube 200 has an upstream end portion 202 and a downstream end portion 204. An upstream gasket (or seal) 210 is fitted into the upstream end portion 202 of the inner tube 200, while at the same time, an outer perimeter 222 of the gasket 210 provides a liquid-tight seal with an interior surface 108 of the outer housing 104. In accordance with an exemplary embodiment, the gasket 210 preferably includes a central, longitudinal air passage (or channel) 220, which opens into an interior 212 of the inner tube 200 that defines a central channel 180.

[0034] Referring to FIG. 10, in accordance with an exemplary embodiment, the gasket 210 can include a rigid tubular gasket insert 240, which can be inserted into a central passage 220 of the gasket 210 and extends at least partially through the central passage 220 of the gasket 210. In accordance with an exemplary embodiment, the gasket insert 240 can be a metal tubular insert, which is configured to provide a precisely defined orifice or outlet 224 so to consistently provide a desired resistance-to-draw from one electronic smoking article 100 to the next. In this embodiment, the gasket 210 may be constructed of a resilient material so that its

capacity to seal remains intact. The rigid insert 240 not only provides a way to exactly control RTD, but also facilitates effecting a change in the desired RTD, which would require only a change in the inner diameter of the insert 240.

[0035] The central, longitudinal passage 220 has an upstream end 221 and a downstream end 223. In accordance with an exemplary embodiment, air enters the electronic smoking article 100 through one or more inlets 190 in the outer housing 104. The upstream end 221 of the longitudinal air passage 220 is in fluid communication with the one or more inlets 190. In accordance with an exemplary embodiment, the downstream end 223 of the longitudinal passage 220 has a gasket outlet 224. Once the air enters the cartomizer section 120, the air passes through the gasket outlet 224 before reaching the heater and wick arrangement 170. In accordance with an exemplary embodiment, the gasket outlet 224 can have a fixed cross-sectional shape, for example, round or oval, which helps control the overall resistance-to-draw (RTD) of the electronic smoking article 100 as opposed to external cartomizer holes or vents within the outer housing 104.

[0036] The power source 112 can be a Lithium-ion battery or one of its variants, for example a Lithium-ion polymer battery. The power source 112 may be a Nickel-metal hydride battery, a Nickel cadmium battery, a Lithium-manganese battery, a Lithium-cobalt battery or a fuel cell. In that case, preferably, the electronic smoking article 100 is usable by a smoker until the energy in the power supply is depleted. The power source 112 may be rechargeable and include circuitry allowing the battery to be chargeable by an external charging article. In that case, the circuitry, when charged, provides power for a pre-determined number of puffs, after which the circuitry may be re-connected to an external charging article.

[0037] The electronic smoking article 100 also includes control circuitry 114, which can be on a printed circuit board (not shown). Once the pressure switch is pressed, the power supply is activated and supplies power to the heater 172. The control circuitry 114 can also include a heater activation light (not shown) operable to glow when the heater 172 is activated. Preferably, the heater activation light comprises an LED and is at an upstream end 106 of the electronic smoking article 100 so that the heater activation light makes end 106 glow with the appearance of a burning coal during a puff.

[0038] The control circuitry 114 is electrically connected to the pressure switch (not shown) and supplies power to a heater 172 of a heater and wick arrangement 170, which is responsive to pressing the pressure switch, preferably with a maximum, time-period limiter (e.g. a timing circuit). The control circuitry 114 can also include a timer operable to limit the time for which power is supplied to the heater 172. The time-period of the electric current supply to the heater 172 may be pre-set depending on the amount of liquid desired to be vaporized. The control circuitry 114 can be programmable for this purpose. The control circuitry can be an application specific integrated circuit (ASIC).

[0039] In accordance with an exemplary embodiment, the cartomizer section 120 includes a reservoir 142 including a liquid material 144 and a heater and wick arrangement 170 that draws or wicks liquid material 144 from the reservoir 142 and heats the liquid to form an aerosol in a central air channel 214. Upon completing the threaded connection, the power source 112 is electrically connected with the heater and wick arrangement 170. The liquid material 144 can include a tobacco-containing material including volatile tobacco flavor compounds, which are released from the liquid material 144 upon heating. The liquid material 144 may also be a tobacco flavor containing material and/or a nicotine-containing material. Alternatively, or in addition, the liquid material 144 may include a non-tobacco material and/or may be nicotine-free. For example, the liquid material 144 may include water, solvents, ethanol, plant extracts and natural or artificial flavors. Preferably, the liquid material 144 further includes an aerosol former. Examples of suitable aerosol formers are glycerine and propylene glycol.

[0040] The electronic smoking article 100 further includes a mouth-end insert 160, which is in fluid communication with the condensation chamber 150 and includes at least two diverging outlets (not shown), for example 3, 4, 5, or preferably 6 to 10 outlets or more. Preferably, four outlets of the mouth-end insert 160 are located at ends of off-axis passages and are angled outwardly in relation to the longitudinal direction of the electronic smoking article 100 (i.e., divergently). As used herein, the term "off-axis" denotes at an angle to the longitudinal direction of the electronic cigarette. Also preferably, the mouth-end insert 160 includes outlets uniformly distributed around the mouth-end insert 160 so as to substantially uniformly distribute aerosol in a smoker's mouth during use. Thus, as the aerosol passes into

a smoker's mouth, the aerosol enters the mouth and moves in different directions so as to provide a full mouth feel as compared to electronic cigarettes having an on-axis single orifice, which directs the aerosol to a single location in a smoker's mouth.

[0041] In an embodiment, the electronic smoking article 100 is about the same size as a conventional cigarette. In some embodiments, the electronic cigarette 60 can be about 80 mm to about 110 mm long, preferably about 80 mm to about 100 mm long and about 7 mm to about 8 mm in diameter. For example, in an embodiment, the electronic cigarette is about 84 mm long and has a diameter of about 7.8 mm.

[0042] The outer cylindrical housing 102 of the electronic smoking article 100 may be formed of any suitable material or combination of materials. Examples of suitable materials include metals, alloys, plastics or composite materials containing one or more of those materials, or thermoplastics that are suitable for food or pharmaceutical applications, for example polypropylene, polyetheretherketone (PEEK), ceramic, low density polyethylene (LDPE) and high density polyethylene (HDPE). Preferably, the material is light and non-brittle. Thus, the outer cylindrical housing 102 can be formed of a variety of materials including plastics, rubber and combinations thereof. In a preferred embodiment, the outer cylindrical housing 102 is formed of silicone. The outer cylindrical housing 102 can be any suitable color and/or can include graphics or other indicia printed thereon.

[0043] The heater and wick arrangement 170 can include an electrical heating element. The heater portion 172 of the heater and wick arrangement 170 preferably includes an electrically resistive material. Suitable electrically resistive materials include but are not limited to: semiconductors such as doped ceramics, electrically "conductive" ceramics (such as, for example, molybdenum disilicide), carbon, graphite, metals, metal alloys and composite materials made of a ceramic material and a metallic material. Such composite materials may include doped or undoped ceramics.

[0044] In an exemplary embodiment, the volatilized liquid material 144 formed as described herein can at least partially condense to form an aerosol including particles. Preferably, the particles contained in the vapor and/or aerosol range in size from about 0.5 micron to about 4 microns, preferably about 1 micron to about 4

microns. Also preferably, the particles are substantially uniform throughout the vapor and/or aerosol.

[0045] FIG. 2 is a perspective view of the gasket 210 of the cartomizer section 140 of an electronic smoking article 100 with and without the outer housing 104 according to an exemplary embodiment. As shown in FIG. 2, the gasket 210 can include an annular portion 242 having a central, longitudinal air passage 220 having a fixed inner diameter. In accordance with an exemplary embodiment, the longitudinal air passage 220 can be configured to provide a desired resistance-to-draw (RTD) to the smoking article 100, when a total air flow area of the one or more inlets 190 of the outer cylindrical housing 102 is greater than a cross-sectional area of the longitudinal air passage 220 of the gasket 210. In accordance with an exemplary embodiment, by modifying or changing the size or diameter of the longitudinal air passage 220 of the gasket 210 and corresponding cross-sectional area (or diameter) of the gasket outlet 224, the RTD of the electronic smoking article can be controlled from inside the electronic smoking article 100 rather than based on the inlets 190 on the outer housing 102.

[0046] In accordance with another exemplary embodiment, the gasket 210 can be made out of any hard material that is easily machineable, for example, plastic (PET, PEEK), stainless steel or metal to maintain a desired diameter of the longitudinal air passage 220 of the gasket 210, which can be used to define the RTD of the electronic smoking article. In accordance with an exemplary embodiment, for example, if the gasket 210 is manufactured from a relatively hard material, an annular seal or O-ring (not shown) can be positioned around the outer perimeter 222 of the gasket 210 to form a seal between the outer perimeter 222 of the gasket 210 and inner portion of the outer housing 104.

[0047] FIG. 3 is a perspective view of an electronic smoking article 100 having a connector 300 for connecting the reusable fixture 110 to the cartomizer section 120. In accordance with an exemplary embodiment, air flow enters the electronic smoking article 100 through a plurality of circumferentially spaced apart slots 302 generated by "castling" within the connector 300. The plurality of slots 302 in combination with an outer surface of the cartomizer section 120 forms a continuous annular channel 350 between an inner surface of the plurality of flanges 320 and the outer surface of the cartomizer section 120. The continuous annular channel 350 is configured to be

in fluid communication with the one or more cartomizer vent holes 340. After entering through the plurality of slots 302 into the annular channel 350, the air enters the cartomizer 140 through one or more cartomizer vent holes 340, which are in fluid communication with the annular channel 350.

[0048] In accordance with an exemplary embodiment, the one or more cartomizer vent holes 340 are circumferentially spaced around the cartomizer section 120 and provide a controlling parameter for the resistance-to-draw (RTD) of the electronic smoking article 100. In accordance with an exemplary embodiment, for example, the electronic smoking article 100 can be configured with two cartomizer vent holes 340, which are circumferentially spaced apart approximately 180 degrees from one another on an outer portion of the cartomizer 140. The two or more cartomizer vent holes 340 are configured to be in fluid communication with the longitudinal air passage 220 of the cartomizer 140.

[0049] In accordance with an exemplary embodiment, depending upon the RTD desired, the one or more cartomizer vent holes 340 and the slots 302 within the connector 300 are configured in such a way that blocking the cartomizer vent holes 340 does not affect the RTD of the electronic smoking article 100. For example, the number and size of slots 302 can be designed in such a way that blocking any of the slots 302 would not change the RTD, which allows consumers to hold and use the article 100 as per their convenience. In accordance with an exemplary embodiment, a combined air flow area of the plurality of circumferentially spaced apart slots 302 is preferably greater than a combined cross-sectional area of the one or more cartomizer holes 340, which allows the one or more cartomizer holes 340 to control the resistance-to-draw of the electronic smoking article.

[0050] As shown in FIG. 4, the connector 300 has a cylindrical housing 310 with a first end 312 and a second end 314. The first end 312 has a plurality of flanges 320 (or "castles"), which are concentric to the first end 312 of the connector 300, and one or more openings 330 formed between the plurality of flanges 320. The plurality of flanges 320 and the one or more openings 330 form the plurality of slots 302 when the reusable fixture (or first section) 110 and the replaceable cartomizer section (or second section) 120 are coupled together. The one or more openings 330 are configured to allow air to enter into a continuous annular channel 350 on an

upstream end 121 of the cartomizer section 120. Each of the plurality of flanges 320 preferably has a relatively round portion 322 and an angled portion 324.

[0051] In accordance with an exemplary embodiment as shown in FIGS. 4-6, the connector 300 can include four slots 302, which includes two diametrically opposite slots 302, which are aligned with two or more cartomizer vent holes 340 with the other two slots 302 not in alignment with the two or more cartomizer vent holes 340. As shown in FIG. 5, the two or more cartomizer vent holes 340 are located within the continuous annular channel 350. In accordance with an exemplary embodiment, openings for each of the two or more cartomizer vent holes 340 are configured to face the upstream end 106 of the article 100, such that the axes for each of the two or more cartomizer vent holes 340 are preferably perpendicular to the outer housing 102 of the electronic smoking article 100.

[0052] In accordance with an exemplary embodiment, for example, to achieve a target RTD of about 100 to 130 mm of water, the cartomizer vent holes 340 can have a diameter of about 0.50 to about 1.0 mm, and more preferably a diameter of about 0.63 mm and the width of the one or more slots can be about 1.0 mm to 3.0 mm, for example, 1.25 mm to 2.75 mm. However, the diameter of the of the cartomizer holes 340 can vary from about 0.50 mm to about 1.50 mm depending on the desired resistance-to-draw of the electronic smoking article in combination with one or more design features of the cartomizer 140 and the amount of air flow which is desired in the interior 212 of the inner tube 200 of the cartomizer 140.

[0053] FIG. 5 is a perspective view of an electronic smoking article having a connector as shown in FIG. 3 in accordance with an exemplary embodiment. For example, in accordance with an exemplary embodiment, in order to achieve a target resistance-to-draw (RTD) in a range of about 100 mm to about 130 mm of water, the cartomizer hole 340 size can be approximately 0.63 mm, which can produce a resistance-to-draw of about 119 mm of water when each of the four slots 302 are open and/or unobstructed.

[0054] As shown in FIG. 5, the airflow 360 enters the electronic smoking article 100 through the one or more slots 302 and into the cartomizer 140 through two or more cartomizer vent holes 340, which are in fluid communication with the heater and wick arrangement 170. In accordance with an exemplary embodiment, the two

or more cartomizer vent holes 340 are positioned within the outer cylindrical housing 102 such that if one or more of the slots 302 is blocked or obstructed, the flow of air 360 is allowed to enter the cartomizer vent holes 340 via the annular channel 350.

[0055] FIG. 6 is another perspective view of an electronic smoking article having a connector as shown in FIG. 3 in accordance with an exemplary embodiment. For example, as shown in FIG. 6, in accordance with an exemplary embodiment, the electronic smoking article 100 can include two cartomizer vent holes 340 having a diameter of approximately 0.63 mm and four slots 302. In accordance with an exemplary embodiment, in which both the slots 302 aligned with the cartomizer holes 340 can produce a resistance-to-draw (RTD) of about 135 mm of water. In an exemplary embodiment, in which one slot 302 aligned with one of the two cartomizer holes 340 is blocked and/or obstructed, and a second slot 302 at about 90 degrees to the first slot 302 is also blocked and which is not aligned with the second of the two cartomizer holes 340, the electronic smoking article 100 can produce a resistance-to-draw of about 137 mm of water.

[0056] FIG. 7 is a perspective view of an electronic smoking article 100 having one or more vent holes 400 within the reusable fixture 110 of the electronic smoking article 100 and a flow control insert 500. In accordance with an exemplary embodiment, the air vent holes 400 can be placed in the reusable fixture (or battery end) 110 of the electronic smoking article 100. As shown in FIG. 7, the air enters the electronic smoking article 100 through the plurality of vent holes 400, which are in fluid communication with the opening (not shown) on the upstream end of the cartomizer 140 in the cartomizer section 120 to the electronic smoking article 100. For example, the plurality of vent holes 400 can be in fluid communication with the gasket 210. The air will enter the cartomizer 140 through the gasket outlet 224.

[0057] FIG. 8 is a perspective view of a flow control insert 500 of the electronic smoking article 100 as shown in FIG. 7. As shown in FIG. 8, the one or more vent holes 400 can be positioned on a downstream portion of the reusable fixture 110, for example, at a downstream end of the power source (or battery) 112. The one or more vent holes 400 are preferably located around an outer circumference of the outer housing 102 in such a way that if one or more of the vent holes 400 are blocked during use, the blocking of the one or more holes 400 does not change the RTD of the electronic smoking article 100. In accordance with an exemplary

embodiment, the one or more vent holes 400 are in fluid communication with an inner cavity 410 located between a downstream end of the power source 112 and an upstream end 420 of a flow control insert 500, which connects the reusable fixture 110 to the cartomizer section 140. The insert 500 can include a cylindrical housing 510 having an upstream end 512 and a downstream end 514. In accordance with exemplary embodiment, the cylindrical housing 510 has a flange 520 on the downstream end 514. Upon assembly of the electronic smoking article 100, the flange 520 is visible between the reusable fixture 110 and the cartomizer section 140. In accordance with an exemplary embodiment, for example, an air flow area of the one or more vent holes 400 is greater than an air flow area (or cross-sectional area) of one or more cartomizer inlets 530.

[0058] In accordance with an exemplary embodiment as shown in FIG. 7, the insert 500 can have one or more cartomizer inlets 530 on an upstream plate 540, which controls the amount of air, which is delivered the cartomizer section 140. The one or more cartomizer inlets 530 are in fluid communication with the one or more vent holes 400 in the outer housing 102 and the inner cavity 410 and provide a means for controlling the amount of air flow to the cartomizer section 140 and the corresponding RTD of the electronic smoking article 100. In accordance with an exemplary embodiment, the one or more cartomizer inlets 530 is a single or one round opening positioned within a center portion of the upstream plate 540. For example, the one or more cartomizer inlets 530 can have a diameter of about 0.8 to 1.0 mm.

[0059] The teachings herein are applicable to electronic cigars, and references to "electronic smoking article(s)" is intended to be inclusive of electronic cigars, electronic cigarettes and the like.

[0060] When the word "about" is used in this specification in connection with a numerical value, it is intended that the associated numerical value include a tolerance of $\pm 10\%$ around the stated numerical value. Moreover, when reference is made to percentages in this specification, it is intended that those percentages are based on weight, for example, weight percentages.

[0061] Moreover, when the words "generally" and "substantially" are used in connection with geometric shapes, it is intended that precision of the geometric

shape is not required but that latitude for the shape is within the scope of the disclosure. When used with geometric terms, the words "generally" and "substantially" are intended to encompass not only features, which meet the strict definitions, but also features, which fairly approximate the strict definitions.

[0062] It will now be apparent that a new, improved, and nonobvious electronic cigarette has been described in this specification with sufficient particularity as to be understood by one of ordinary skill in the art. Moreover, it will be apparent to those skilled in the art that numerous modifications, variations, substitutions, and equivalents exist for features of the electronic cigarette, which do not materially depart from the spirit, and scope of the invention. Accordingly, it is expressly intended that all such modifications, variations, substitutions, and equivalents, which fall within the spirit and scope of the invention as defined by the appended claims, shall be embraced by the appended claims.

What is Claimed is:

1. An electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprising:
 - an outer cylindrical housing extending in a longitudinal direction, the outer cylindrical housing having one or more inlets configured to allow air to be drawn into the electronic smoking article;
 - a power source;
 - a cartomizer, which includes:
 - a reservoir;
 - a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol; and
 - a gasket in fluid communication with the one or more inlets and configured to provide a seal with an interior surface of the outer cylindrical housing and having a central, longitudinal air passage configured to provide resistance-to-draw (RTD) to the electronic smoking article, and wherein a combined air flow area of the one or more inlets of the outer cylindrical housing is greater than a cross-sectional area of the longitudinal air passage of the gasket;
 - a condensation chamber in communication with an outlet on a downstream end of the cartomizer; and
 - a mouth-end insert.
2. The electronic smoking article of claim 1, wherein the gasket is positioned on an upstream end of the cartomizer, and is configured to control an amount of air flow to the cartomizer during use, and wherein the amount of air flow through the gasket is mixed with the volatilized liquid material within the cartomizer to produce the aerosol.
3. The electronic smoking article of claim 1, comprising:
 - a rigid tubular insert configured to fit within the gasket, and wherein an inner diameter of the rigid tubular insert defines the fixed diameter of the gasket, and

which is configured to provide the resistance-to-draw (RTD) to the electronic smoking article.

4. The electronic smoking article of claim 1, wherein the gasket is made of a plastic, stainless steel, or a metal, which provides rigidity to the gasket.

5. The electronic smoking article of claim 1, wherein the heater and wick arrangement comprises a heated capillary tube, wherein the heater is operable to heat the capillary tube to a temperature sufficient to at least initially volatilize liquid material contained within the capillary tube.

6. The electronic smoking article of claim 1, comprising:
control circuitry operable to control supply of power from the power source to the heater and wick arrangement.

7. An electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprising:
a reusable portion housing a power source and circuitry;
a cartomizer portion housing a cartomizer, which includes:
a reservoir; and
a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol;
a condensation chamber in communication with an outlet on a downstream end of the air flow channel; and
a mouth-end insert; and
a connector configured to connect the reusable portion to the cartomizer portion, and wherein the connector has a plurality of circumferentially spaced apart slots, which is in fluid communication with one or more cartomizer holes, and wherein the one or more cartomizer holes are configured to provide a source of air flow to the heater and wick arrangement of the cartomizer, and wherein a combined air flow area of the plurality of circumferentially spaced apart slots is greater than a combined cross-sectional area of the one or more cartomizer holes.

8. The electronic smoking article of claim 7, wherein the one or more cartomizer holes are in fluid communication with a continuous annular channel formed in an outer portion of the electronic smoking article, and axes of the one or more cartomizer holes are perpendicular to an outer housing of the electronic smoking article.

9. The electronic smoking article of claim 7, wherein the one or more cartomizer holes is two cartomizer holes and the plurality of circumferentially spaced apart slots comprises four slots.

10. The electronic smoking article of claim 7, wherein the connector has a cylindrical housing with a first end and a second end, the first end having a plurality of flanges which are concentric to the first end of the connector and one or more openings formed between the plurality of flanges, and wherein the one or more openings form the plurality of slots when the reusable portion and the cartomizer portion are coupled together.

11. The electronic smoking article of claim 10, wherein each of the plurality of flanges has a relatively round portion and an angled portion.

12. The electronic smoking article of claim 11, comprising:
a continuous annular channel formed between an outer surface of the cartomizer and an inner portion of the plurality of flanges, and wherein the continuous annular channel is in fluid communication with the one or more cartomizer holes.

13. The electronic smoking article of claim 7, wherein the heater and wick arrangement comprises a heated capillary tube, wherein the heater is operable to heat the capillary tube to a temperature sufficient to at least initially volatilize liquid material contained within the capillary tube.

14. An electronic smoking article capable of providing a cigarette experience without combusting tobacco, comprising:
a reusable portion housing a power source and circuitry;

a cartomizer portion housing a cartomizer, which includes:
a reservoir; and
a heater and wick arrangement in communication with the reservoir including liquid material and operative to volatilize liquid material to produce an aerosol;
a condensation chamber in communication with an outlet on a downstream end of the air flow channel; and
a mouth-end insert; and
at least one vent hole positioned in the reusable portion of the electronic smoking article between a downstream end of the power source and the cartomizer portion, and wherein the at least one vent hole is in fluid communication with a flow control insert located on an upstream end of an air flow channel of the cartomizer, the flow control insert having at least one cartomizer inlet configured to control an amount of air flow to the cartomizer, and wherein an air flow area of the at least one vent hole is greater than an air flow area of the at least one cartomizer inlet.

15. A method of controlling resistance-to-draw of an electronic smoking article, which includes a reusable portion and a cartomizer portion, the method comprising:

supplying an air flow from one or more inlets in an outer cylindrical housing of the electronic smoking article to a cartomizer via a cartomizer inlet having a fixed diameter configured to control a resistance-to-draw of the electronic smoking article and wherein the cartomizer inlet is located inside the outer cylindrical housing of the electronic smoking article, and wherein a combined air flow area of the one or more inlets in the outer housing of the electronic smoking article is greater than a cross-sectional area of the cartomizer inlet;

heating a liquid material from a reservoir to form an aerosol in a central air channel;

combining the at least initially volatilized liquid material with the air flow from the cartomizer inlet; and

condensing the saturated vapor within the condensation chamber in communication with the air flow channel to form the aerosol.

16. The method of claim 15, wherein the cartomizer inlet comprises:

a gasket in fluid communication with the one or more inlets in the outer cylindrical housing and wherein the gasket is configured to provide a seal with an interior surface of the outer cylindrical housing, and having a central, longitudinal air passage having a fixed inner diameter configured to provide the resistance-to-draw (RTD) to the electronic smoking article, and wherein a combined air flow area of the one or more inlets of the outer cylindrical housing is greater than a cross-sectional area of the longitudinal air passage of the gasket.

17. The method of claim 15, wherein the cartomizer inlet comprises:

a connector configured to connect the reusable portion to the cartomizer portion, and wherein the connector has a plurality of circumferentially spaced apart slots, which is in fluid communication with one or more cartomizer holes, and wherein the one or more cartomizer holes are configured to provide a source of air flow to a heater and wick arrangement of the cartomizer, and wherein a combined air flow area of the plurality of circumferentially spaced apart slots is greater than a combined cross-sectional area of the one or more cartomizer holes.

18. The method of claim 15, wherein the one or more inlets in the outer housing of the electronic smoking article comprises:

at least one vent hole positioned in the reusable portion of the electronic smoking article between a downstream end of the power source and the cartomizer portion, and wherein the at least one vent hole is in fluid communication with a flow control insert located on an upstream end of an air flow channel of the cartomizer, the flow control insert having the cartomizer inlet configured to control an amount of air flow to the cartomizer, and wherein an air flow area of the one or more inlets is greater than an air flow area of the at least one cartomizer inlet.

19. The method of claim 15, comprising:

supplying the aerosol to a smoker via a mouth-end insert.

20. A method of establishing a common, predetermined RTD consistently amongst a plurality of electronic smoking articles, comprising:

for each electronic smoking article, establishing an airflow path within said electronic smoking article and including at a location along said airflow path a passage through a resilient gasket; and

for each electronic smoking article, determining an RTD by disposing a common, rigid tubular member at a location along said passageway, said tubular member having an inner diameter that establishes said common, predetermined RTD in said electronic smoking article.

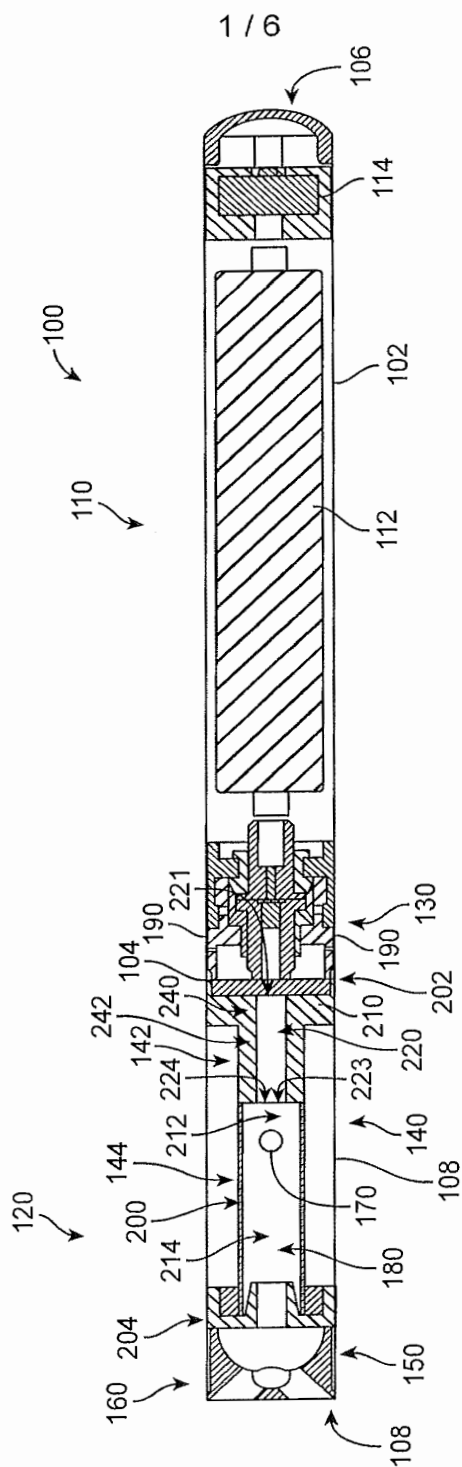


FIG. 1

2 / 6

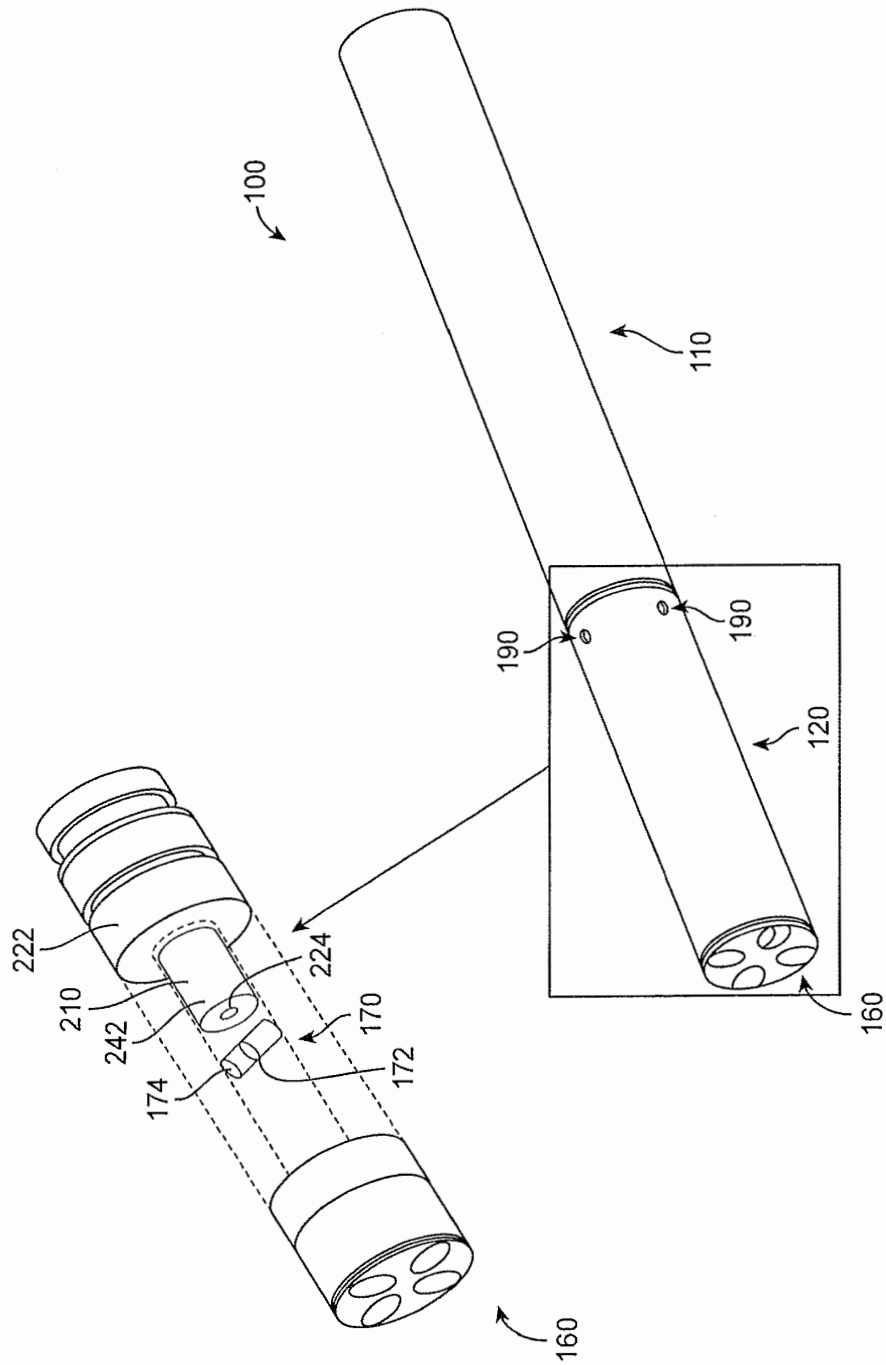
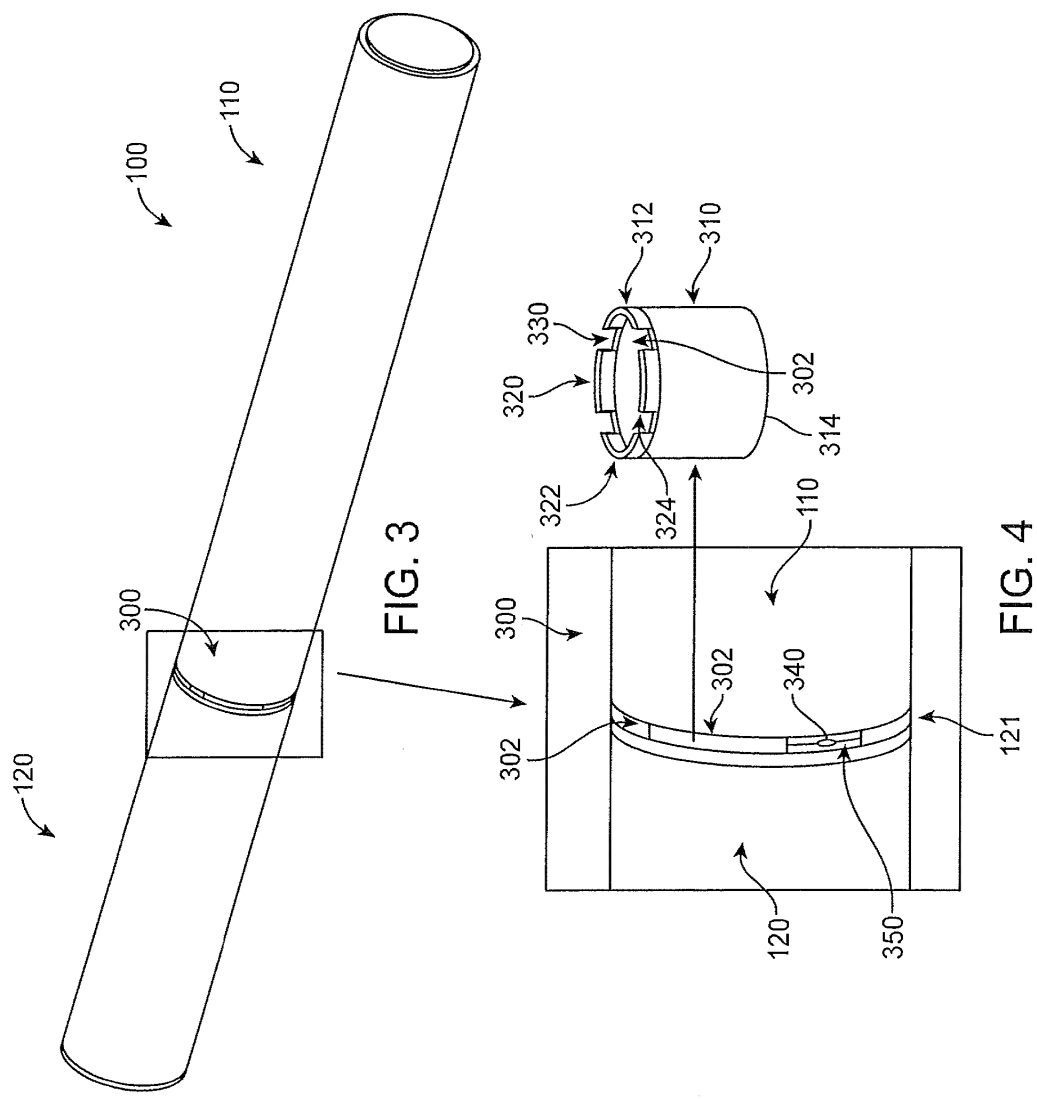


FIG. 2



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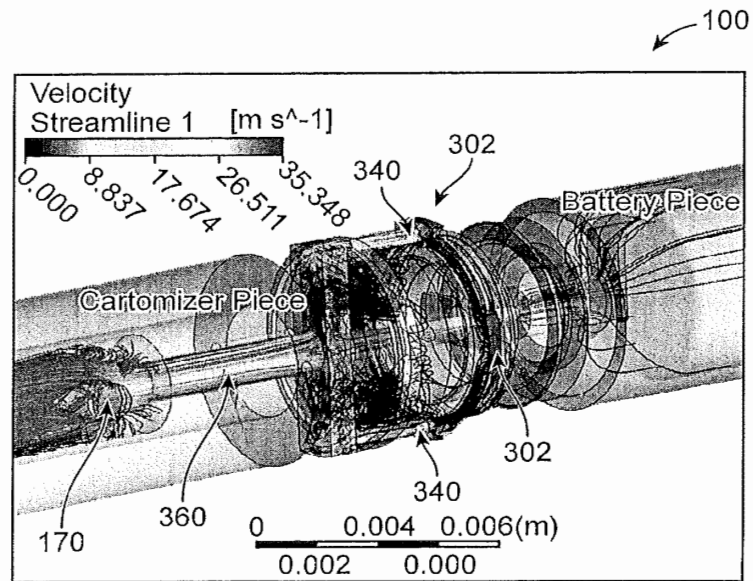


FIG. 5

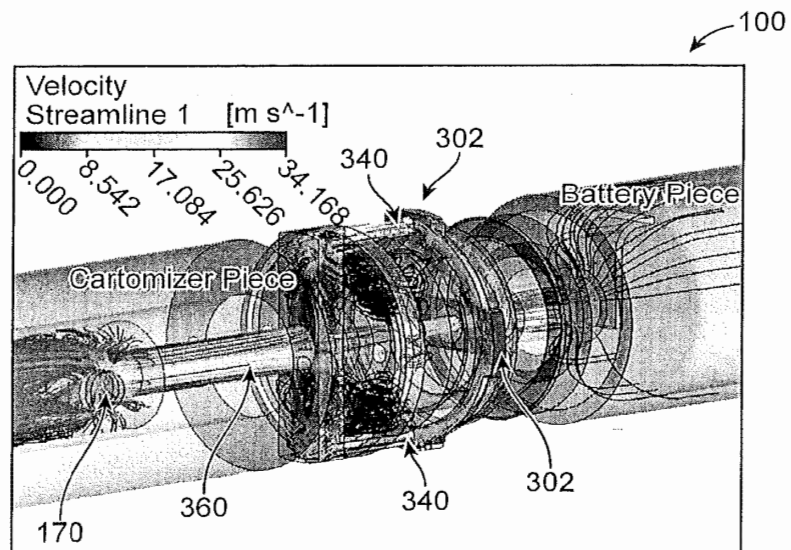


FIG. 6

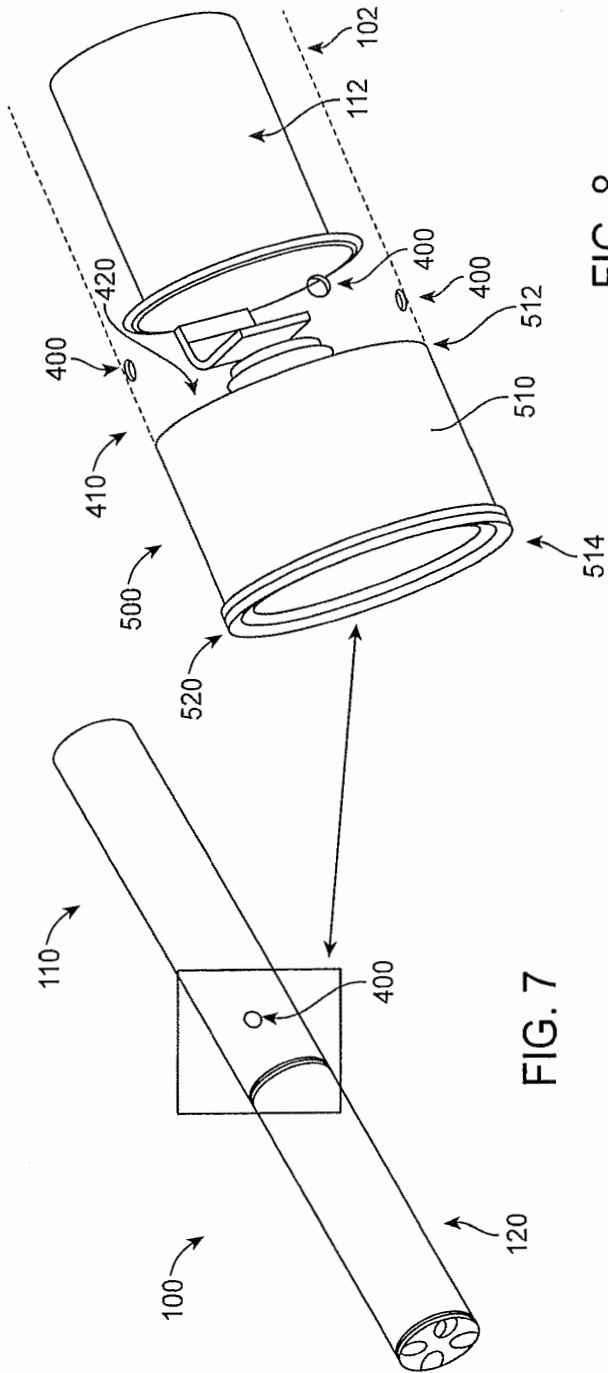


FIG. 7

FIG. 8

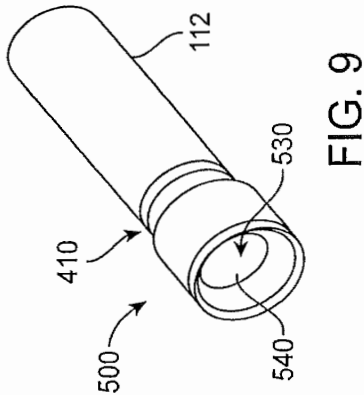


FIG. 9

6 / 6

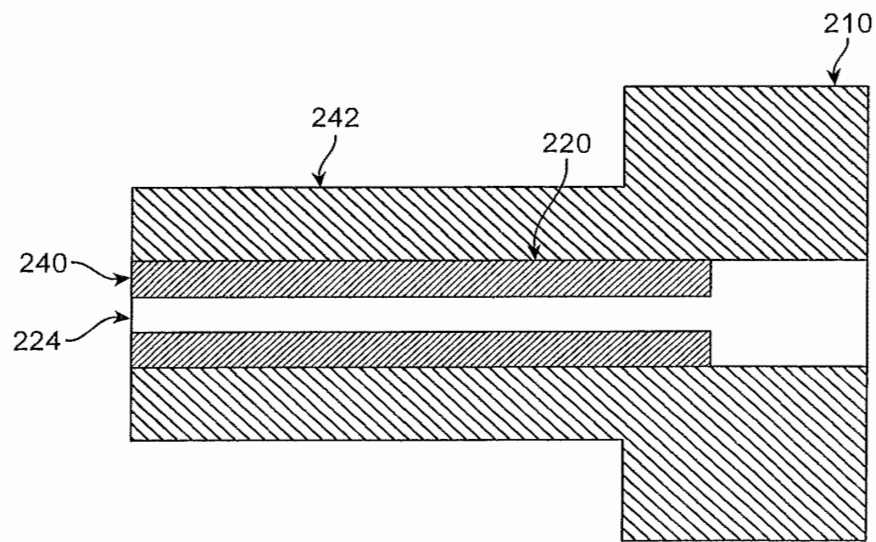


FIG. 10

(12) 按照专利合作条约所公布的国际申请

(19) 世界知识产权组织
国际局

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(81) 指定国 (除另有指明, 要求每一种可提供的国家保护): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW。

(84) 指定国 (除另有指明, 要求每一种可提供的地区保护): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), 欧亚 (AM, AZ, BY, KG, KZ, RU, TJ, TM), 欧洲 (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG)。

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(54) Title: ELECTRONIC CIGARETTE

(54) 发明名称: 电子烟

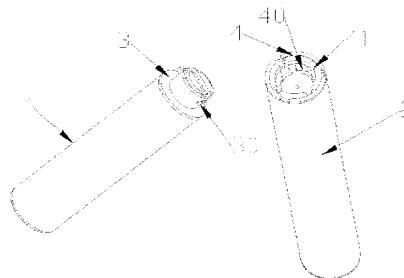


图 1 / Fig.1

(57) Abstract: An electronic cigarette comprises an atomization component (1) and a battery component (2). A butt joint position of the atomization component (1) and the battery component (2) is provided with a connection structure used for connecting the atomization component (1) to the battery component (2). The connection structure comprises a first connection part (3) and a second connection part (4) that are butt jointed, wherein the second connection part (4) is provided with a butt joint notch for the first connection part (3) to insert into. A protrusion of an elastic part (30) is convexly arranged inward in a radial direction on an inner wall of the butt joint notch or outward in a radial direction on the first connection part (3). A clamping slot (40) matched with the protrusion is arranged on an inner side of the second connection part (4) or on an outer side of the first connection part (3). During butt jointing, the first connection part (3) is inserted into the butt joint notch, and rotated to make the protrusion pressed and deformed. When the elastic part (30) is rotated to a position relative to the clamping slot (40), the elastic part (30) collides with an inner wall of the clamping slot (40) to make a prompt sound. The connection structure of the electronic cigarette is simple, and provides an in-place prompt function. User experience is high.

(57) 摘要:

[见续页]

WO 2015/027435 A1

**本国际公布:**

— 包括国际检索报告(条约第 21 条(3))。

一种电子烟，包括雾化组件（1）以及电池组件（2），所述雾化组件（1）与所述电池组件（2）的对接处设置有助于连接所述雾化组件（1）和所述电池组件（2）的连接结构，所述连接结构包括相互对接的第一连接件（3）及第二连接件（4），其中，所述第二连接件（4）设有供所述第一连接件（3）插入的对接槽；所述对接槽的内壁径向向内凸设有或者从所述第一连接件（3）径向向外凸设有凸起的弹性件（30），所述第二连接件（4）内侧或所述第一连接件（3）外侧设置有与所述凸起相适配的卡槽（40）；扣接时，所述第一连接件（3）插入所述对接槽，旋转使所述凸起受压迫并发生形变，旋转至所述弹性件（30）与所述卡槽（40）位置相对时，所述弹性件（30）撞击所述卡槽（40）的内壁产生提示声。所述电子烟连接结构简单，且具有到位提示功能，用户体验高。

说明书

发明名称：电子烟

技术领域

- [1] 本发明涉及电加热产品领域，更具体地说，涉及一种电子烟。

背景技术

- [2] 电子烟一般包括雾化组件和电池组件，现有技术中的电子烟中，雾化组件与电池组件之间的连接方式多为螺纹连接 的连接方式。由于螺纹式连接方式需要旋转多圈才能实现牢固固定，在旋转过程中，旋转不到位，可能存 在连接不牢固的缺陷，而旋转过度可能对电子烟造成损坏，用户在旋转过程中不能获得任何固定到位的提示声音，且现有的连接方式结构不简单，操作复杂，使用不方便，不利于戒烟，用户体验差。

发明内容

- [3] 本发明要解决的技术问题在于为解决现有技术中的电子烟的雾化组件与电池组件连接方式结构复杂及无法获知固定是否到位的缺陷，提供一种连接牢固且具有到位提示功能的电子烟。
- [4] 本发明解决其技术问题所采用的技术方案是：提供一种电子烟，包括雾化组以及电池组件，所述雾化组件与所述电池组件的对接处设置有用连接所述雾化组件和所述电池组件的连接结构，所述连接结构包括相互对接的第一连接件以及第二连接件，其中，
- [5] 所述第二连接件设有用于供所述第一连接件插入的对接槽，所述第二连接件或所述第一连接件设有弹性件，所述弹性件从所述对接槽的内壁处径向向内凸设有或者从所述第一连接件径向向外凸设有凸起；相应地，所述第一连接件外侧或所述第二连接件的所述对接槽内壁设置有与所述凸起相适配的卡槽；
- [6] 扣接时，所述第一连接件插入所述对接槽，旋转使所述凸起受压迫发生形变，所述凸起旋转至所述卡槽时，撞击所述卡槽的内壁产生提示声，并使所述凸起置于所述卡槽内。
- [7] 本发明的电子烟中，所述第二连接件包括设置有所述对接槽的卡弹座，所述卡

弹座开口端径向向内形成限位阶，所述卡弹座侧壁开设有至少一个导向槽，所述凸起沿所述导向槽插入所述对接槽中，所述卡弹座内壁靠近所述导向槽具有突出于所述卡弹座内壁的第一台阶，所述第一台阶包括靠近所述导向槽的第一阶面，所述第一台阶与所述卡弹座内壁围成所述卡槽。

- [8] 本发明的电子烟中，相邻所述导向槽之间还设置有第二台阶，所述第二台阶包括与所述第一阶面同向倾斜的第二阶面，所述第一台阶与所述第二台阶及所述第一台阶与所述第二台阶之间的所述卡弹座内壁形成所述卡槽。
- [9] 本发明的电子烟中，所述第二台阶背离所述第二阶面的另一侧与所述导向槽相连通。
- [10] 本发明的电子烟中，所述卡槽为凹位。
- [11] 本发明的电子烟中，所述第一连接件上径向向外凸设有所述凸起的所述弹性件为具有环形结构的弹片，所述凸起为所述弹片部分径向向外突出形成的凸筋。
- [12] 本发明的电子烟中，所述第一连接件包括用于实现所述雾化组件与所述电池组件之间的电性连接的第一外电极，所述第一外电极侧壁开设了用于突出所述凸筋的第一通孔，所述弹性件安装在所述第一外电极内，所述凸筋穿过所述第一通孔突出于所述第一外电极外侧。
- [13] 本发明的电子烟中，所述第一外电极内插置有用于实现所述雾化组件与所述电池组件之间的电性连接的第一内电极，所述第一内电极与所述弹性件之间设置有第一绝缘件，所述第一绝缘件外侧壁缩径形成用于安装所述弹性件的环形凹槽。
- [14] 本发明的电子烟中，所述弹性件为卡固并突出于所述第一连接件外侧壁或所述第二连接件内侧壁的弹块。
- [15] 本发明的电子烟中，所述弹块包括固定套及部分地套设在所述固定套内并与所述固定套活动连接的所述凸起。
- [16] 本发明的电子烟中，所述凸起与所述固定套形成有容置腔，所述容置腔内插置有弹簧，所述弹簧一端抵接所述凸起，所述弹簧的另一端抵接所述容置腔的底部，所述弹簧用于向所述凸起提供沿所述电子烟径向的弹性力。
- [17] 本发明的电子烟中，所述第一连接件外侧壁凸设有卡扣凸块，所述卡扣凸块位

于所述弹性件或所述卡槽远离所述第二连接件的一侧，所述卡扣凸块插入所述第二连接件，经旋转后限位在所述对接槽内。

[18] 本发明的电子烟中，所述第一连接件外侧壁凸设有卡扣环，所述卡扣环位于所述弹性件或所述卡槽远离所述第二连接件的一侧，所述第二连接件开口端具有与所述卡扣环形状相适配的导向面，所述卡扣环经所述导向面插入所述对接槽，经旋转后，所述凸起置于所述卡槽内，所述卡扣环卡位在所述对接槽中。

[19] 实施本发明的电子烟，具有以下有益效果：通过在组装电子烟的过程中，经旋转是所述弹性件撞击所述卡槽产生提示声可实现对第一连接件以及第二连接件固定到位的提示，同时通过设置导向槽及相邻导向槽之间的两个台阶，在弹性件撞击第一台阶时发出提示声指示固定到位，继续旋转至弹性件撞击第二台阶再次发出提示声指示此时可对第一连接件与第二连接件进行拆分，本发明的连接方式结构简单，连接方便。

附图说明

[20] 下面将结合附图及实施例对本发明作进一步说明，附图中：

[21] 图1是本发明的电子烟的第一实施例的分解结构示意图；

[22] 图2是图1所示电子烟的第一连接件的剖视图；

[23] 图3是图2所示第一连接件的爆炸图；

[24] 图4是图1所示电子烟的第二连接件的剖视图；

[25] 图5是图4所示第二连接件的爆炸图；

[26] 图6是图5所示第二连接件的卡弹座的第一实施方式的示意图；

[27] 图7是图5所示第二连接件的卡弹座的第二实施方式的示意图；

[28] 图8是本发明的电子烟的第一实施例的整体剖视图；

[29] 图9是本发明的电子烟的第二实施例的分解结构示意图；

[30] 图10是图9所示电子烟的连接结构的爆炸图；

[31] 图11是图10所示连接结构的剖视图；

[32] 图12是图11所示连接结构的弹性件的示意图；

[33] 图13是本发明的电子烟的第三实施例的分解结构示意图；

[34] 图14是图13所示电子烟的连接结构的爆炸图。

具体实施方式

- [35] 为了对本发明的技术特征、目的和效果有更加清楚的理解，现依据附图对本发明的具体实施方式进行了说明。
- [36] 本发明提供一种电子烟，如图1至图8所示，包括雾化组件1以及电池组件2，雾化组件1以及电池组件2的对接处设置有连接结构，所述连接结构包括相互对接的第一连接件3以及第二连接件4，第二连接件4设有用于供第一连接件3插入的对接槽。所述第一连接件3或所述第二连接件4设置有弹性件30，所述弹性件30从所述对接槽的内壁处径向向内凸设有或者从所述第一连接件3径向向外凸设有凸起35，对应于所述凸起35，所述第一连接件3的外侧或所述对接槽内壁设置有与所述凸起35相适配的卡槽40。对接槽上开设了导向通道，扣接时，第一连接件3沿所述导向通道插入所述对接槽中，然后旋转使凸起35受压迫并回缩，旋转至凸起35与卡槽40位置对应时，凸起35恢复形变、撞击卡槽40的内壁，最终凸起35弹置于卡槽40中。本实施例中的导向通道为开设在所述对接槽侧壁的导向槽41。可以理解的是，弹性件30沿导向槽41插入对接槽中，旋转后受对所述对接槽的内壁压迫发生形变。当所述弹性件30设置在所述对接槽内壁时，所述弹性件30在第一连接件3插入所述对接槽后旋转的过程中，受所述第一连接件3的外侧壁压迫而发生形变。
- [37] 具体参考图2，第一连接件3包括第一外电极31，第一外电极内插置了第一内电极32。第一内电极32与第一外电极31之间设置有第一绝缘件33。本实施例中，弹性件30为具有环形结构的弹片，所述弹片上部分径向向外凸设有凸筋，所述凸筋为本发明中的凸起35。如图2所示，本实施例中，所述第一绝缘件33与第一外电极32通过过盈配合的方式卡合固定连接，所述第一外电极31、第一绝缘件33及第一内电极32相邻两者之间互相限位。如图2所示，第一外电极内侧具有凸缘39，第一绝缘件33的外侧壁通过缩径形成有环形凹槽34，通过环形凹槽34与凸缘39之间的适配实现第一绝缘件33与第一内电极31之间的相对固定。环形弹片30环绕所述第一内电极32置于第一外电极31内并部分突出于第一外电极31外侧。
- [38] 如图3所示，第一外电极31上对应所述弹性件30开设了第一通孔36，弹性件30

置于第一外电极31内，经第一通孔36凸设有凸起35。应当理解，本发明中所述第一绝缘件33外侧壁缩径形成的所述环形凹槽34也可用于安装所述环形弹片，在此情况下，所述环形弹片套设在所述环形凹槽34上，所述凸起35经所述第一通孔36突出于所述第一外电极31外侧，同时所述第一绝缘件33的远离所述对接槽的一端抵接所述凸缘39，所述第一绝缘件33的另一端抵接所述第一内电极32。如图3所述，本实施例中的第一内电极32、第一绝缘件33及第一外电极31均为中空的结构，便于空气流通。

[39] 本实施例中，所述凸起25及所述第一通孔36的个数均为两个，且均匀等间隔设置。

[40] 如图4-5所示，为本实施例中的第二连接件4的结构示意图。本实施例中，第二连接件4包括与第一内电极32电连接的第二内电极44及与第一外电极31电连接的第二外电极42，第二内电极44与第二外电极42之间设置有第二绝缘件43，与图3所示第一连接件3的结构相类似，本实施例中的第二外电极42与第二绝缘件43之间通过过盈配合的方式卡合实现相对固定，所述第二外电极42、第二绝缘件43及第二内电极44相邻两者之间互相限位。此外，本实施例中的第二连接件4还包括设置在所述第二外电极42内的卡弹座45，卡弹座45内设置有所述对接槽。卡弹座45侧壁开设所述导向槽41。

[41] 如图6-7所示，为本实施例中卡弹座45的具体实施方式，参考图6，在第一实施方式中，卡弹座45开设有4个对称分布的导向槽41，相邻两个导向槽41之间的卡弹座45内壁上设置有第一台阶46，所述第一台阶46包括与所述卡弹座45内壁倾斜连接的第一阶面401。所述第一阶面401可以与所述卡弹座45的内壁平滑连接，也可以与所述卡弹座45的内壁具有呈钝角的二面角，由此确保所述凸起35在旋转至所述第一阶面401时既能保证受第一阶面401挤压，同时确保所述凸起35能在第一阶面401上运动。本实施方式中，第一台阶46背离所述第一阶面401的另一侧与所述卡弹座45的内壁垂直，应当理解，第一台阶46背离所述第一阶面401的另一侧与卡弹座45的内壁之间的二面角不限于直角，也可以是锐角，用于保证所述凸起35经旋转至第一台阶46背离所述第一阶面401的另一侧时能垂直落下，并撞击所述卡弹座45内壁发出提示声。

- [42] 如图7所示，在第二实施方式中，卡弹座45周向对称开设了四个导向槽41，相邻两个导向槽之间设置了第一台阶46及第二台阶47，所述第二台阶47具有与所述第一台阶46同向倾斜的第二阶面402。与第一台阶46相类似，第二台阶背离第二阶面402的另一侧与卡弹座45的内壁之间的二面角可以是锐角或直角，用于保证所述凸起35经旋转至第二台阶47背离所述第二阶面402的另一侧时能垂直落下，并撞击所述卡弹座45内壁发出提示声。优选地，第二台阶与导向槽41连通，因此凸起35旋转至第二台阶47后发出提示声，此时用户可沿导向槽41将第一连接件3与第二连接件4拆分开来。
- [43] 如图8所示，本实施例中的第一连接件3通过第一外电极31与雾化组件1的雾化套10之间的过盈配合连接方式扣合在雾化组件1的连接端，第二连接件4通过第二外电极与电池组件2的电池套20之间的过盈配合连接方式扣合在电池组件2的连接端。第一连接件3与第二连接件4之间通过凸起35与卡槽40之间的卡合实现雾化组件1与电池组件2之间的连接。扣接时，所述第一外电极31抵接第二外电极42实现电性连接，第一内电极32抵接第二内电极44实现电性连接。雾化组件1远离所述第一连接件3的一端扣接有吸嘴盖11，吸嘴盖11与第一连接件3之间依次设置有通气管12及雾化座14，通气管12径向插置有电热丝组件13，通气管12外周包覆有储油棉15。发热丝组件13一端电连接至第一内电极32，另一端电连接至第一外电极31。第二连接件2通过过盈配合方式扣接在电池组件2的电池套20的连接端，电池套20远离第二连接件4的一端扣接有端盖24。沿所述端盖24至所述第二连接件2的方向上，电池套20内依次设置有气流感应控制组件22、用于安装所述气流感应控制组件22的安装座23以及电池21，第二内电极44电连接至电池21的正极或负极，第二外电极42电连接至电池21的负极或正极。
- [44] 应当理解，第一外电极31可以过盈配合地插置于雾化组件1的雾化套10上或者电池组件2的电池套20上，同理，第二外电极42过盈配合地插置于电池组件2的电池套20上或者雾化组件1的雾化套10上。
- [45] 可以理解的是，所述弹性件30还可以为卡簧、弹簧丝或者是其他弹性元件。
- [46] 如图9-12所示，为本发明的电子烟的第二实施例。在实施例中，弹性件30设置在第二连接件4的对接槽内壁。与第一实施例不同，本实施例中的对接槽直接形

成于第二外电极42内，第二外电极42开口端径向向内形成限位阶49。与弹性件30相适配的卡槽40在本实施例中为直接开设在第一外电极31上侧壁的凹位。本实施例中的位于卡槽40远离第二连接件4的一侧的第一连接件3的外侧壁上还设置有至少一个卡扣凸块37。对应于所述卡扣凸块37，所述第二外电极42的开口端上开设有导向槽41，扣合时，所述卡扣凸块37沿导向槽41插入所述对接槽内，经旋转后有所述限位阶49进行限位，同时对接槽中的弹性件30在旋转过程中受第一外电极32外侧壁挤压变形，旋转至弹性件30与卡槽40位置对应时，恢复形变、撞击卡槽40产生提示声，同时弹性件30弹置于卡槽40内。

[47] 如图10所示，第一连接件3包括第一外电极31、第一绝缘件33及第一内电极32，三者之间的连接及限位方式与第一实施例相同，在此不作赘述。第二连接件4包括第二外电极42、第二绝缘件43及第二内电极33，三者之间的连接及限位方式与第一实施例相同，在此不作赘述。

[48] 如图11所示，从本实施例中的连接结构的剖视图可以看出，扣接后，第一内电极32抵接第二内电极44，第一外电极31抵接第二外电极42，弹性件30弹置于卡槽40中。

[49] 如图12所示，弹性件30包括固定套301及部分卡合在固定套301中的凸起35，凸起35与固定套301活动连接，凸起35可沿所述电子烟径向运动。为了方便第一连接件3与第二连接件4之间的拆分，本实施例中的凸起35具有弧形的外表面，在将第一连接件3从所述对接槽中拆分出来时，进一步旋转第一连接件3，卡槽40将对凸起35施压，具有弧形外表面的凸起35将受压变形进而伴随旋转从卡槽40中脱离，方便第一连接件3性对接槽中取出。

[50] 优选地，凸起35与固定套301形成有容置腔303，容置腔303中插置有弹簧302。弹簧302一端抵接凸起35，另一端抵接固定套301，弹簧302向凸起35提供沿所述电子烟径向的弹性力。

[51] 应当理解，本实施例中的弹性件30也可以设置在第一连接件3的第一外电极31外侧，例如所述卡扣凸块37的正对位置处，相应地，卡槽40则可以开设在所述对接槽的内侧壁上对应位置处。扣接时，所述卡扣凸块37连同弹性件30沿导向槽41插置到对接槽中，经旋转后卡合固定。

- [52] 如图13-14所示，为本发明电子烟的第三实施例。与第二实施例的不同之处在于，本实施例中的位于卡槽40远离第二连接件4的一侧的第一连接件3的外侧壁上设置有卡扣环38。对应于所述卡扣环38，所述第二外电极42的开口端具有与所述卡扣环形状相适配的导向面48，优选地，卡扣环38的形为非圆形，即所述卡扣环38至少两个方向上的长度具有差异，例如，卡扣环38呈椭圆形、六边形、正方形，以及其它规则或不规则形状。扣合时，所述卡扣环38沿导向面48插入所述对接槽内，经旋转后有所述限位阶进行限位，同时对接槽中的弹性件30在旋转过程中受第一外电极32外侧壁挤压变形，旋转至弹性件30与卡槽40位置对应时，恢复形变、撞击卡槽40的内壁产生提示声，同时弹性件30弹置于卡槽40内。
- [53] 应当理解，以上所述的卡扣凸块37或卡扣环38也可以设置在第一实施例中的第一外电极31上，而第一实施例中的环形弹片也可以应用于第二实施例及第三实施例中。
- [54] 综上：通过设置位置对应从第一连接件3径向外凸出或者从第二连接件4径向内突出的具有凸起的弹性件，以及从第二连接件3外侧壁或者从第二连接件4内侧壁设置的卡槽，扣合时，通过旋转第一连接件3挤压所述凸起35，使所述凸起变形，在所述凸起35与卡槽40位置相对时，所述凸起35恢复形变撞击所述卡槽40进而产生提示声，所述提示声可方便用户知晓此时第一连接件3与第二连接件4之间的连接状态，防止用户过度旋转或旋转不到位引起的连接不牢，同时省时省力，具有结构简单，连接牢固，且连接方便的特点。
- [55] 上面结合附图对本发明的实施例进行了描述，但是本发明并不局限于上述的具体实施方式，上述的具体实施方式仅仅是示意性的，而不是限制性的，本领域的普通技术人员在本发明的启示下，在不脱离本发明宗旨和权利要求所保护的范围情况下，还可做出很多形式，这些均属于本发明的保护之内。

权利要求书

[权利要求 1]

一种电子烟，包括雾化组件（1）以及电池组件（2），所述雾化组件（1）与所述电池组件（2）的对接处设置有助于连接所述雾化组件（1）和所述电池组件（2）的连接结构，所述连接结构包括相互对接的第一连接件（3）以及第二连接件（4），其特征在于，

所述第二连接件（4）设有用于供所述第一连接件（3）插入的对接槽，所述第二连接件（4）或所述第一连接件（3）设置有弹性件（30），所述弹性件（30）从所述对接槽的内壁处径向向内凸设有或者从所述第一连接件（3）径向向外凸设有凸起（35）；相应地，所述第一连接件（3）外侧或所述第二连接件（4）的所述对接槽内壁设置有与所述凸起（35）相适配的卡槽（40）；扣接时，所述第一连接件（3）插入所述对接槽，旋转使所述凸起（35）受压迫发生形变，所述凸起（35）旋转至所述卡槽（40）时，撞击所述卡槽（40）的内壁产生提示声，并使所述凸起（35）置于所述卡槽（40）内。

[权利要求 2]

根据权利要求1所述的电子烟，其特征在于，所述第二连接件（4）包括设置有所述对接槽的卡弹座（45），所述卡弹座（45）侧壁开设有至少一供所述凸起（35）插入的导向槽（41），所述卡弹座（45）内壁靠近所述导向槽（41）具有突出于所述卡弹座（45）内壁的第一台阶（46），所述第一台阶（46）与所述卡弹座（45）内壁围成所述卡槽（40），所述第一台阶（46）包括靠近所述导向槽（41）的第一阶面（401），所述凸起（35）沿所述第一阶面（401）滑动并越过所述第一阶面（401）撞击所述卡槽（40）的内壁时产生所述提示声。

[权利要求 3]

根据权利要求2所述的电子烟，其特征在于，所述卡弹座（45）开口端径向向内缩径形成限位阶（49），所述限位阶（49）用于对所述凸起（35）进行轴向限位。

- [权利要求 4] 根据权利要求2所述的电子烟，其特征在于，相邻的两个所述导向槽（41）之间还设置有第二台阶（47），所述第二台阶（47）包括与所述第一阶面（401）同向倾斜的第二阶面（402），所述第一台阶（46）与所述第二台阶（47）及所述第一台阶（46）与所述第二台阶（47）之间的所述卡弹座（45）内壁形成所述卡槽（40）。
- [权利要求 5] 根据权利要求4所述的电子烟，其特征在于，所述第二台阶（47）背离所述第二阶面（402）的一侧面与远离所述第一台阶（46）的所述导向槽（41）的一侧面位于同一平面内。
- [权利要求 6] 根据权利要求1所述的电子烟，其特征在于，所述卡槽（40）为凹位。
- [权利要求 7] 根据权利要求1所述的电子烟，其特征在于，所述第一连接件（3）上的所述弹性件（30）为具有环形结构的弹片，所述凸起（35）为所述弹片部分径向向外突出形成的凸筋，所述第一连接件（3）插入所述对接槽后，所述凸筋受压迫发生形变，撞击设置在所述对接槽内的所述卡槽（40）的内壁产生提示声。
- [权利要求 8] 根据权利要求7所述的电子烟，其特征在于，所述第一连接件（3）包括用于实现所述雾化组件（1）与所述电池组件（2）之间的电性连接的第一外电极（31），所述第一外电极（31）侧壁开设了用于突出所述凸筋的第一通孔（36），所述弹性件（30）安装在所述第一外电极（31）内，所述凸筋穿过所述第一通孔（36）突出于所述第一外电极（31）外侧。
- [权利要求 9] 根据权利要求8所述的电子烟，其特征在于，所述第一外电极（31）内插置有用于实现所述雾化组件与所述电池组件之间的电性连接的第一内电极（32），所述第一内电极（32）与所述弹性件（30）之间设置有第一绝缘件（33），所述第一绝缘件（33）外侧壁缩径形成用于安装所述弹性件（30）的环形凹槽（34）。
- [权利要求 10] 根据权利要求1所述的电子烟，其特征在于，所述弹性件（33）为

卡固并突出于所述第一连接件（3）外侧壁或所述第二连接件（4）内侧壁的弹块。

[权利要求 11] 根据权利要求10所述的电子烟，其特征在于，所述弹块包括固定套（301）及部分地套设在所述固定套（301）内并与所述固定套（301）活动连接的所述凸起（35）。

[权利要求 12] 根据权利要求11所述的电子烟，其特征在于，所述凸起（35）与所述固定套（301）形成有容置腔（303），所述容置腔（303）内插置有弹簧（302），所述弹簧（302）一端抵接所述凸起（35），所述弹簧（302）的另一端抵接所述容置腔（303）的底部，所述弹簧（302）用于向所述凸起（35）提供沿所述电子烟径向的弹性力。

[权利要求 13] 根据权利要求7所述的电子烟，其特征在于，所述第一连接件（3）外侧壁凸设有卡扣凸块（37），所述卡扣凸块（37）位于所述弹性件（30）或所述卡槽（34）远离所述第二连接件（4）的一侧，所述卡扣凸块（37）插入所述第二连接件（4）内，经旋转后限位在所述对接槽内。

[权利要求 14] 根据权利要求10所述的电子烟，其特征在于，所述第一连接件（3）外侧壁凸设有卡扣凸块（37），所述卡扣凸块（37）位于所述弹性件（30）或所述卡槽（34）远离所述第二连接件（4）的一侧，所述卡扣凸块（37）插入所述第二连接件（4）内，经旋转后限位在所述对接槽内。

[权利要求 15] 根据权利要求6所述的电子烟，其特征在于，所述第一连接件（3）外侧壁凸设有卡扣环（38），所述卡扣环（38）位于所述弹性件（30）或所述卡槽（40）远离所述第二连接件（4）的一侧，所述第二连接件（4）开口端具有与所述卡扣环（38）形状相适配的导向面（48），所述卡扣环（38）经所述导向面（46）插入所述对接槽，经旋转后，所述凸起（35）置于所述卡槽（40）内，所述卡扣环（38）卡位在所述对接槽中。

[权利要求 16] 根据权利要求10所述的电子烟，其特征在于，所述第一连接件（3）外侧壁凸设有卡扣环（38），所述卡扣环（38）位于所述弹性件（30）或所述卡槽（40）远离所述第二连接件（4）的一侧，所述第二连接件（4）开口端具有与所述卡扣环（38）形状相适配的导向面（48），所述卡扣环（38）经所述导向面（48）插入所述对接槽，经旋转后，所述凸起（35）置于所述卡槽（40）内，所述卡扣环（38）卡位在所述对接槽中。

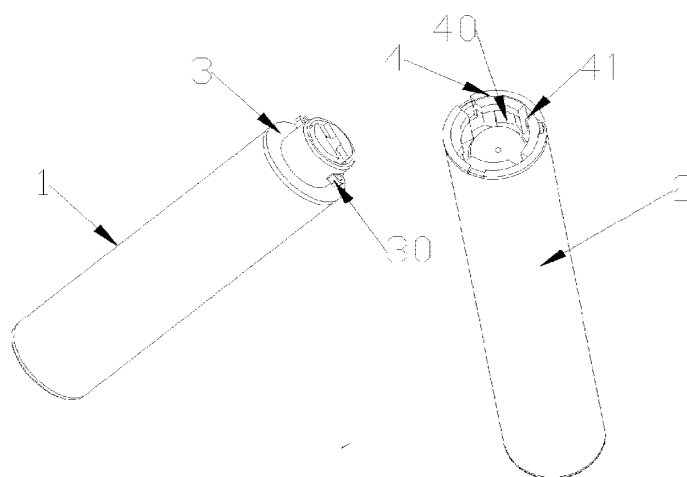


图 1

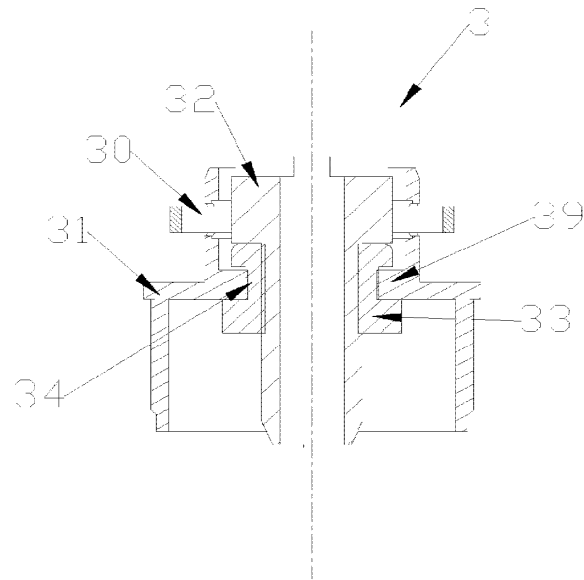


图 2

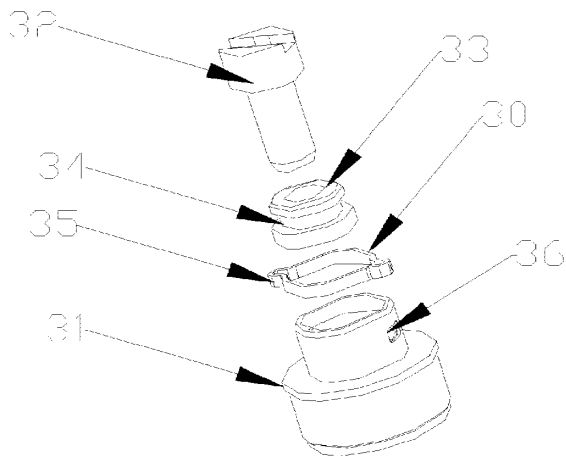


图 3

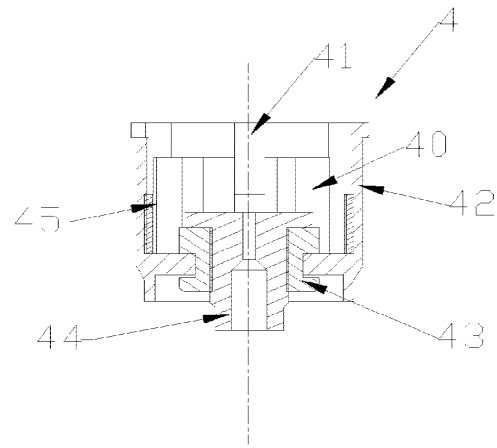


图 4

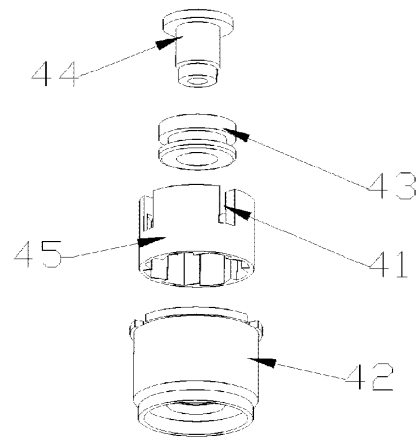


图 5

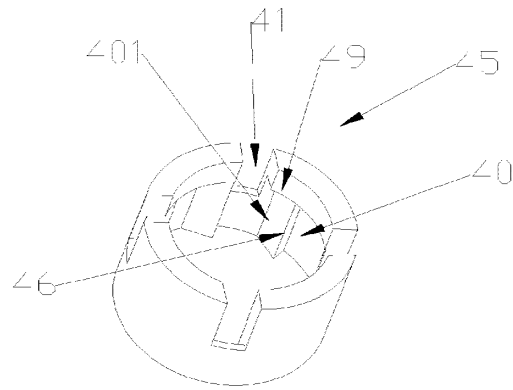


图 6

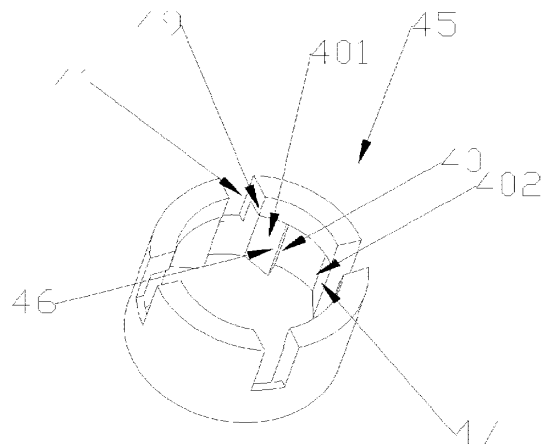


图 7

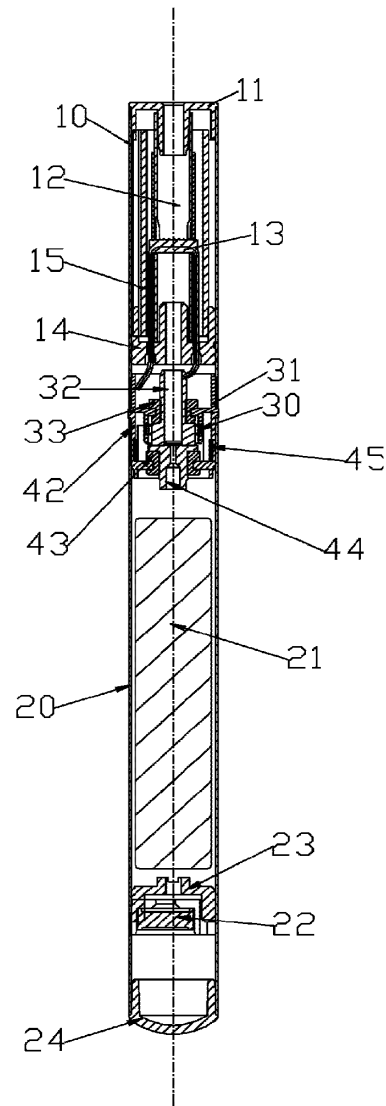


图 8

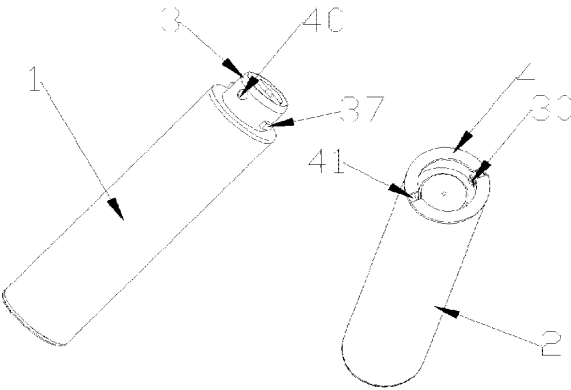


图 9

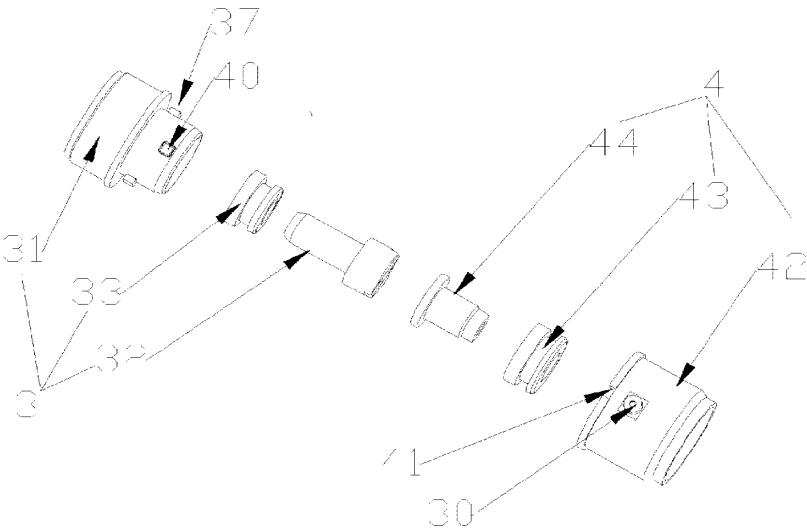


图 10

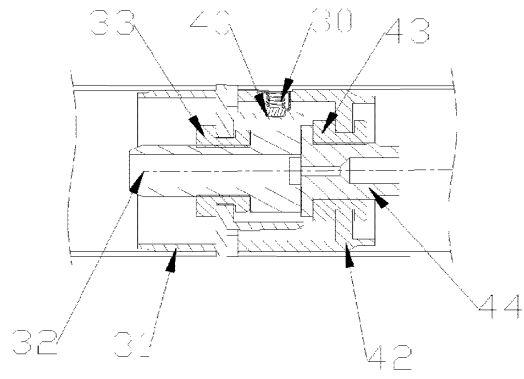


图 11

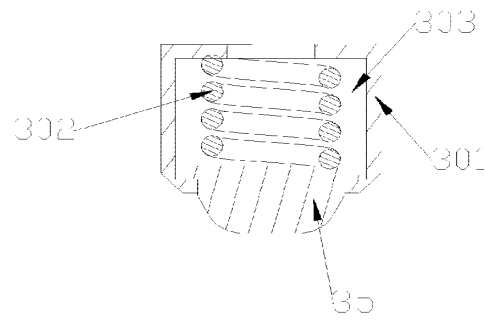


图 12

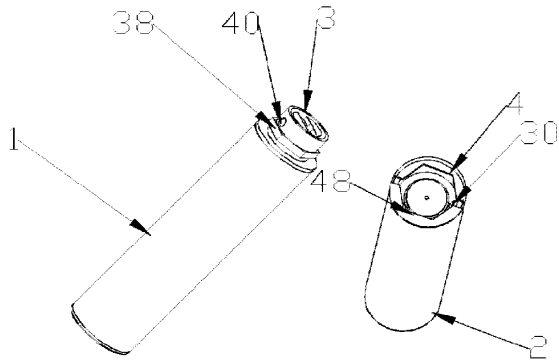


图 13

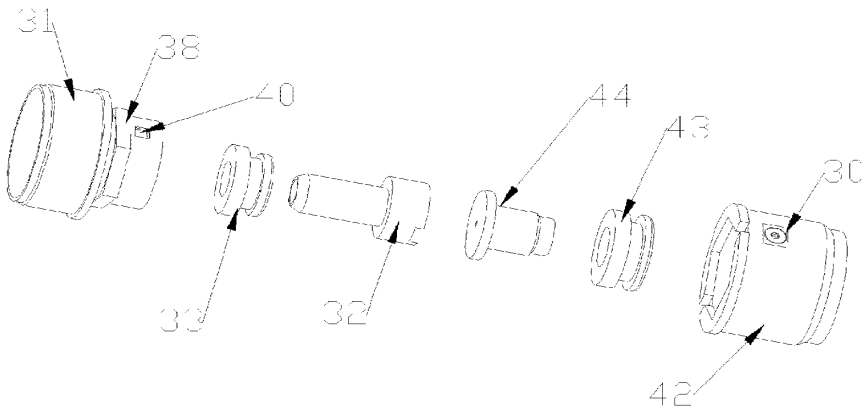


图 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/082575

A. CLASSIFICATION OF SUBJECT MATTER

A24F 47/00 (2006.01) i

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 47

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)

CPRSABS, CNABS, CNTXT, CNKI, VEN: electronic cigarette, cigarette, snap fit, fastener, groove, protrude+, convex, concave, elastic, connect, element, sound, voice, hook+, compress+, first, second, warning tone

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 203435686 U (LIU, Qiuming) 19 February 2014 (19.02.2014) description, paragraphs [0035]-[0055], and claims 1-10	1-10
Y	CN 202127820 U (LI, Yonghai et al.) 01 February 2012 (01.02.2012) description, paragraphs [0019]-[0023], and figures 1-6	1-16
Y	WO 2010140841 A2 (EBACO CO LTD) 09 December 2010 (09.12.2010) description, pages 13-77, figures 1, 2, 40-50, 58 and 59	1-16
A	CN 203058296 U (SHENZHEN INDER ELECTRONIC CO LTD) 17 July 2013 (17.07.2013) the whole document	1-16
A	CN 102920028 A (SHENZHEN FIRST UNION TECHNOLOGY CO LTD) 13 February 2013 (13.02.2013) the whole document	1-16

☐ Further documents are listed in the continuation of Box C.

☒ 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

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search
14 May 2014

Date of mailing of the international search report
28 May 2014

Name and mailing address of the ISA
State Intellectual Property Office of the P. R. China
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Telephone No. (86-10) 62085741

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/082575

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 203435686 U	19 February 2014	None	
CN 202127820 U	01 February 2012	None	
WO 2010140841 A2	09 December 2010	WO 2010140841 A3	10 March 2011
		WO 2010140841 A2	09 December 2010
		KR 20100012095 U	10 December 2010
		KR 20100012901 U	29 December 2010
		KR 20110084386 A	22 July 2011
		KR 20110079589 A	07 July 2011
		KR 20110003309 U	31 March 2011
		KR 20110132290 A	07 December 2011
		KR 1269246 B1	29 May 2013
		KR 20110004157 U	27 April 2011
		KR 1184082 B1	18 September 2012
		KR 20110079591 A	07 July 2011
		KR 20110132289 A	07 December 2011
		KR 2011005304 U	31 May 2011
		KR 20110079587 A	07 July 2011
		KR 20110123703 A	15 November 2011
		KR 20110004156 U	27 April 2011
		KR 1162688 B1	05 July 2012
CN 203058296 U	17 July 2013	None	
CN 102920028 A	13 February 2013	None	

国际检索报告

国际申请号

PCT/CN2013/082575

A. 主题的分类 A24F 47/00(2006.01)i 按照国际专利分类(IPC)或者同时按照国家分类和IPC两种分类		
B. 检索领域 检索的最低限度文献(标明分类系统和分类号) A24F47 包含在检索领域中的除最低限度文献以外的检索文献 在国际检索时查阅的电子数据库(数据库的名称, 和使用的检索词(如使用)) CPRSABS, CNABS, CNXTX, CNKI: 电子烟, 卡扣, 卡槽, 突, 凸, 凹, 弹性, 接插件, 插接件, 声, 音, 第一, 第二, 提示音, 提示声 VEN: electronic cigarette, cigarette, sound, voice, hook+, groove, compress+, first, second		
C. 相关文件		
类 型*	引用文件, 必要时, 指明相关段落	相关的权利要求
E	CN 203435686U (刘秋明) 2014年 2月 19日 (2014 - 02 - 19) 说明书第35-55段, 权利要求1-10	1-10
Y	CN 202127820U (李永海等) 2012年 2月 01日 (2012 - 02 - 01) 说明书第19-23段, 附图1-6	1-16
Y	WO 2010140841A2 (EBACO CO LTD) 2010年 12月 09日 (2010 - 12 - 09) 说明书第13-77页, 附图1-2, 40-50, 58-59	1-16
A	CN 203058296U (深圳市英德尔电子有限公司) 2013年 7月 17日 (2013 - 07 - 17) 全文	1-16
A	CN 102920028A (深圳市合元科技有限公司) 2013年 2月 13日 (2013 - 02 - 13) 全文	1-16
☐ 其余文件在C栏的续页中列出。 ☒ 见同族专利附件。		
* 引用文件的具体类型: “A” 认为不特别相关的表示了现有技术一般状态的文件 “E” 在国际申请日的当天或之后公布的在先申请或专利 “L” 可能对优先权要求构成怀疑的文件, 或为确定另一篇引用文件的公布日而引用的或者因其他特殊理由而引用的文件(如具体说明的) “O” 涉及口头公开、使用、展览或其他方式公开的文件 “P” 公布日先于国际申请日但迟于所要求的优先权日的文件 “T” 在申请日或优先权日之后公布, 与申请不相抵触, 但为了理解发明之理论或原理的在后文件 “X” 特别相关的文件, 单独考虑该文件, 认定要求保护的发明不是新颖的或不具有创造性 “Y” 特别相关的文件, 当该文件与另一篇或者多篇该类游戏文件结合并且这种结合对于本领域技术人员为显而易见时, 要求保护的发明不具有创造性 “&” 同族专利的文件		
国际检索实际完成的日期 2014年 5月 14日		国际检索报告邮寄日期 2014年 5月 28日
ISA/CN的名称和邮寄地址 中华人民共和国国家知识产权局(ISA/CN) 北京市海淀区蓟门桥西土城路6号 100088 中国 传真号 (86-10)62019451		受权官员 彭志萍 电话号码 (86-10)62085741

表 PCT/ISA/210 (第2页) (2009年7月)

国际检索报告
关于同族专利的信息

国际申请号

PCT/CN2013/082575

检索报告引用的专利文件		公布日 (年/月/日)	同族专利	公布日 (年/月/日)
CN	203435686U	2014年 2月 19日	无	
CN	202127820U	2012年 2月 01日	无	
WO	2010140841A2	2010年 12月 09日	WO 2010140841A3	2011年 3月 10日
			WO 2010140841A2	2010年 12月 09日
			KR 20100012095U	2010年 12月 10日
			KR 20100012901U	2010年 12月 29日
			KR 20110084386A	2011年 7月 22日
			KR 20110079589A	2011年 7月 07日
			KR 20110003309U	2011年 3月 31日
			KR 20110132290A	2011年 12月 07日
			KR 1269246B1	2013年 5月 29日
			KR 20110004157U	2011年 4月 27日
			KR 1184082B1	2012年 9月 18日
			KR 20110079591A	2011年 7月 07日
			KR 20110132289A	2011年 12月 07日
			KR 2011005304U	2011年 5月 31日
			KR 20110079587A	2011年 7月 07日
			KR 20110123703A	2011年 11月 15日
			KR 20110004156U	2011年 4月 27日
			KR 1162688B1	2012年 7月 05日
CN	203058296U	2013年 7月 17日	无	
CN	102920028A	2013年 2月 13日	无	

表 PCT/ISA/210 (同族专利附件) (2009年7月)

International Bureau



WIPO | PCT



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(43) International Publication Date
5 March 2015 (05.03.2015)

G07F 13/02 (2006.01) *G07F 13/10* (2006.01)
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PCT/GB2014/052626

29 August 2014 (29.08.2014)

English

English

1315499.2 30 August 2013 (30.08.2013)

GB

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(81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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— with international search report (Art. 21(3))

(74) **Agent:** DAVIES, Simon; D Young & Co LLP, 120 Holborn, London EC1N 2DY (GB).

(54) Title: APPARATUS AND METHOD FOR DISPENSING LIQUIDS INTO A CONTAINER

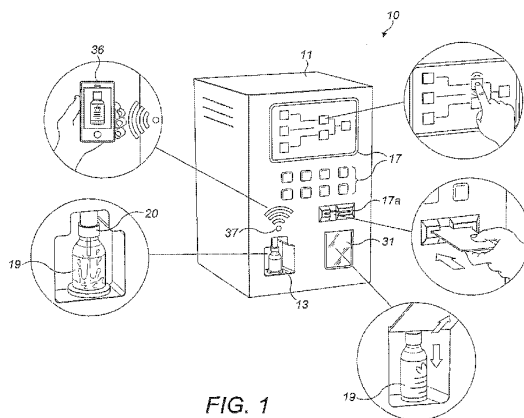


FIG. 1

(57) Abstract: A machine for dispensing a vaporisable liquid into a container for use in an electronic inhalation device is disclosed. The machine comprises a reservoir of liquid, a dispensing port to receive an empty container to be filled, and a dispensing mechanism fluidly connected to the reservoir for dispensing a quantity of liquid from the reservoir to a container received in the dispensing port. The machine also comprises a controller connected to the dispensing mechanism to control operation thereof, and a user-operable interface connected to the controller for a user to actuate the machine. Also disclosed is a method of operation of such a machine and a system of a plurality of such machines.

WO 2015/028815 A1

NJOY Exhibit 1002.2813

APPARATUS AND METHOD FOR DISPENSING LIQUIDS INTO A CONTAINER**Technical Field**

This specification relates to an apparatus and method for dispensing liquids into a container.

5

Background

Electronic cigarettes ("e-cigarettes") may comprise a reservoir of liquid which is vaporised or atomised by the device for inhalation by a user. Once the liquid supply is exhausted, the reservoir must be replaced by a new full reservoir of liquid, in the case of disposable reservoirs, or must be refilled, in the case of reusable reservoirs.

10

Summary

In this specification there are described embodiments of an apparatus or machine for dispensing a vaporisable liquid into a container for use in an electronic inhalation device, the machine comprising a reservoir for containing liquid, a dispensing port to receive an empty container to be filled, a dispensing mechanism fluidly connected to the reservoir for dispensing a quantity of liquid from the reservoir to a container received in the dispensing port, a controller connected to the dispensing mechanism to control operation thereof, and a user-operable interface connected to the controller for a user to actuate the machine.

15

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In this specification there is also described a method of operating an apparatus or machine for dispensing a vaporisable liquid into a container for use in an electronic inhalation device, the method comprising receiving a dispensing instruction via a user-operable interface connected to a controller, the controller actuating a dispensing mechanism to dispense a quantity of liquid from a reservoir of the machine to a dispensing port and into a container held in the dispensing port.

25

Brief Description of the Drawings

Figure 1 shows a perspective view of a vending machine of a first embodiment;

Figure 2 shows a functional schematic view of the vending machine shown in Figure 1;

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Figure 3 shows an operational flow chart of the vending machine of Figures 1 and 2;

Figure 4 shows a schematic cross-sectional view of a portion of the dispensing mechanism of the vending machine shown in Figures 1 – 2, with a cartomizer held in the dispensing port;

Figures 5A and 5B respectively show views of a cartomizer and dispensing head of a second embodiment, separately and in engagement;

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Figures 6A and 6B respectively show views of a cartomizer and dispensing head of a third embodiment, separately and in engagement;

Figure 7 shows a first exemplary data flow diagram of the vending machine shown in Figures 1 – 2;

Figure 8 shows a second exemplary data flow diagram of the vending machine shown in Figures 1 – 2 including network components; and

Figure 9 shows an exemplary logic flow diagram of operation of the vending machine shown in Figures 1 – 2.

Detailed Description

5 Referring to Figures 1 and 2, there is shown a vending machine 10 according to a first embodiment for dispensing liquid for use in electronic vapour inhalation devices such as e-cigarettes (hereinafter referred to as e-liquid). The vending machine 10 comprises a housing 11 within which is provided a plurality of e-liquid reservoirs 12. Each reservoir 12 may contain a different formulation of e-liquid, although alternatively, the same e-liquid may be contained in each reservoir 12.

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The vending machine 10 comprises a dispensing port 13 configured to receive an e-liquid container of an electronic vapour inhalation device (known as a “cartomizer”) and a dispensing mechanism 14 associated with the dispensing port 13 and configured to fill a cartomizer 19 received in the dispensing port 13 with e-liquid from one or more of the reservoirs 12. The dispensing mechanism 14
15 is fluidly connected to each of the reservoirs 12 by supply pipes 15 and each supply pipe 15 includes a supply valve 16 to control the flow of e-liquid from the respective reservoir 12 to the dispensing mechanism 14 and out of the dispensing port 13.

The vending machine 10 includes a user interface 17 and a controller 18 connected to the user
20 interface 17. A memory unit 26 is also connected to the controller 18. The user interface 17 is operable by a user to initiate an e-liquid dispensing operation and to select, if appropriate, a choice of e-liquid formulation from the options available from the vending machine 10. The user interface 17 may also be operable to take payment from a user by means of card payment device, a pre-paid card reader, or other wireless or otherwise payment means 17a. Furthermore, the user interface may also
25 be configured to perform an age-verification function to determine that the user is authorised to use the vending machine. This may be by input of a user-specific code or a user-ID recognition device such as a RFID tag and receiver, or user-ID card reader. It is also intended that the vending machine 10 may be operated by input or reading of a “smart” token, via the user interface 17, 17a that can only be bought from a licensed retailer upon proof of minimum age of the purchaser, to ensure age-
30 verification. Such token may also only be usable in combination with password/pass code to further ensure secure operation and prevent unauthorised use.

The controller 18 is connected to the supply valves 16 and to the dispensing mechanism 14 and is configured to control these in response to input from a user via the user interface 17 to effect
35 dispensing of e-liquid into a cartomizer received in the dispensing port 13. The dispensing port 13 is configured to receive an empty cartomizer 19 and to seal around an open end of the cartomizer 19. The cartomizer 19 may be held within the dispensing port 13 by a screw thread, bayonet fitting or other releasable coupling. The dispensing mechanism 14 comprises a dispensing head 20 which includes an e-liquid supply duct 21 and a vacuum duct 22. The liquid supply duct 21 is fluidly
40 connected to the supply pipes 15, and the vacuum duct 22 is connected to a vacuum pump 23. When

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a cartomizer 19 is held in the dispensing port 13, the ends of the liquid supply duct 21 and vacuum duct 22 are in fluid communication with the inside of the cartomizer 19. The liquid supply duct 21 may extend further into the interior of the cartomizer 19 than the vacuum supply duct 22 and the latter terminating adjacent the open end of the cartomizer 19, as can be seen in Figure 4.

5

The vending machine 10 includes a sterilising device 24 which is configured to clean and sterilise user-supplied cartomizers 19 prior to being filled with e-liquid. The sterilising device comprises an ultrasonic emitter which is disposed proximate the dispensing port 13 and positioned such that it is close to a cartomizer 19 when received therein, and which is configured to emit ultrasonic sound waves to the cartomizer 19. The sterilising device 24 may emit sound waves in the frequency range of 20 – 400 kHz for optimum sterilising efficacy.

10

The vending machine 10 includes a cartomizer marking mechanism 25 which is configured to print information on a cartomizer 19 received in the dispensing port 13 relating to the details and formulation of the e-liquid dispensed into the cartomizer. For example, this information may comprise the time, date and location of dispensing, the ingredient levels or formulation of the e-liquid, such as nicotine content and/or flavour information, health warning or other regulatory information, and any associated branding, logo or trade mark. This information may be printed directly onto a side wall of a cartomizer 19 whilst being held in the dispensing port 13 by a printing head 27, such as an ink-jet printer head. However, in an alternative embodiment, the information could be printed onto an adhesive label which may either be automatically applied to the side of a cartomizer 19 by an automated labelling mechanism (not shown) whilst the cartomizer 19 is held in the dispensing port 13, or could be separately supplied from a label dispenser (not shown) on the vending machine 10 for a user to manually adhere to the filled cartomizer 19 of e-liquid once filled.

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The controller 18 is connected to both the sterilisation device 24 and the marking mechanism 25 to control the operation of both.

Although the vending machine 10 is configured to receive user-supplied cartomizers 19 and refill them, the vending machine also includes a cartomizer supply mechanism 28 whereby, if a user does not have an empty cartomizer 19 to be refilled, the vending machine 10 can provide a new empty cartomizer 19 to be filled. The cartomizer supply mechanism 28 includes a magazine 29 to hold a stock of new empty cartomizers 19 and supply device 30 to feed an empty cartomizers 19 from the magazine 29 to a cartomizer dispensing aperture 31, from which a user may retrieve the dispensed cartomizer and manually insert it into the dispensing port 13. Embodiments are envisaged in which the supply device 30 may alternatively, or also, be configured to supply empty cartomizers 19 directly from the magazine 29 to the dispensing port 13 and automatically fit the cartomizer therein ready to be filled with the dispensed e-liquid.

30

35

A mode of operation of the vending machine 10 will now be described, with reference to the operational flow chart of figure 3. The user may initially operate the user interface 17 to initiate an e-liquid dispensing procedure, at step S1. The user would use the user interface 17 to pass the age verification security check, either by entry of a specific code, reading of an identity card or detection of a RFID identity tag, or other appropriate means, at step S2, and the controller 18 determines at step S3 whether the age verification check is valid or not. If not, the controller operates a display portion of the user interface 17 to indicate age verification error (step S4) and requests the user to re-confirm the age verification check. If the vending machine is configured with different e-liquids in the various reservoirs 12, the user may input via the user interface 17 their choice of e-liquid formulation to be dispensed into the cartomizer 19 at step S5.

At step S6, the user then operates the user-interface 17 and payment means 17a to effect payment for dispensing of the selected e-liquid.

At step S7, the controller queries whether the user has their own used cartomizer to be refilled, or requires a new cartomizer to be provided by the vending machine 10. If the user indicates via the user interface 17 that a new cartomizer is required, the controller operates the cartomizer supply mechanism 28 so that the supply device 30 collects a cartomizer 19 from the magazine 29 and provides it to the dispensing aperture 31 (step S8). The user may then insert their empty cartomizer 19, or newly provided cartomizer 19, into the dispensing port 13 and secure it in place as appropriate by the screw thread, bayonet fitting, or other fitment, so that the dispensing head 20 seals over the opening in the cartomizer 19.

It will be appreciated that if a user requires a new cartomizer to be dispensed, this will have an additional cost than if a user supplies their own used cartomizer. As such, the user may, at earlier step S5, input via the user interface 17 whether they have their own used cartomizer to be refilled or require a new cartomizer to be provided by the vending machine 10 and then, at payment step S6, payment may be taken to include payment for a new cartomizer if necessary. In such a process, at step S7, the vending machine 10 queries whether the user has selected at step S5, and paid for at step S6, a new cartomizer to be supplied. This information as to whether a new cartomizer is required may be stored in the memory 26 and queried by the controller 18 at step S7.

The controller 18 then determines, at step S9, whether the cartomizer 19 is fitted into the dispensing port 13. If not, it loops back to repeat the enquiry until it detects a cartomizer in place.

At step S10, the controller 18 activates the sterilising device 24 to sterilise the cartomizer 19 held within the dispensing port 13 prior to initiating a filling operation. The sterilising device may comprise an ultrasonic emitter actuated by the controller 18 to emit ultrasonic sound waves at the device. Alternatively, or in addition, the sterilising device 24 may comprise a sterilising fluid supply means fluidly connected to the dispensing head 20 by a sterilising fluid duct, configured to introduce a

sterilising liquid or gas into the cartomizer 19, and subsequently evacuate the sterilising fluid, before a filling operation occurs. Such sterilising fluid may comprise water, liquid chemical disinfectant, or a sterilising gas. In an embodiment, sterilising fluid is used in combination with an ultrasonic emitter for enhanced sterilising efficacy. Yet further, the dispensing port 13 may be provided with a drying
5 device, such as an infra-red heater or an air duct to blow flushing, possibly heated, clean air into the cartomizer, to dry the interior thereof and flush out/evaporate any residual sterilising fluid, before a filling operation commences.

Following completion of the sterilising procedure, the controller 18 actuates the dispensing
10 mechanism 14 to dispense e-liquid into the cartomizer 19 at step S11. The controller 18 operates respective supply valve 16 to allow the chosen e-liquid to flow from the reservoir 12 through the supply pipe 15 to the dispensing head 20 of the dispensing mechanism 14. The controller also actuates the vacuum pump 23 so that air is drawn out of the cartomizer 19 through the vacuum duct 22 to create a reduced pressure within the cartomizer 19. This draws the e-liquid through the supply
15 pipe 15, through the supply duct 21 in the dispensing head 20 and into the cartomizer 19.

The vending machine 10 may include a flow meter in the supply duct 21 or supply pipe 15 and, for example, which is or may be connected to the controller 18, to measure the amount of e-liquid dispensed and to control the supply valve 16 to shut and the vacuum pump 23 to stop when the
20 required volume of e-liquid has been dispensed to fill the cartomizer 19. In an alternative embodiment however, the supply duct 21 may not extend fully into the bottom of the cartomizer 19 but may terminate at a predetermined fill level within the cartomizer 19. The supply duct may include a pressure-sensing valve that senses a back pressure in the duct when the liquid level in the cartomizer reaches the pre-determined fill level and then closes to prevent any more e-liquid being dispensed
25 into the cartomizer 19. At step S12, the vending machine 10 determines whether the cartomizer 19 is filled with e-liquid, by either detecting a fill level of the e-liquid within the cartomizer, or by detecting when a pre-determined volume of e-liquid has been dispensed, or when a pressure sensing valve in the supply duct 21 closes. At step S13, the controller 18 stops dispensing e-liquid if it is detected at step S12 that the cartomizer has been filled.

30 After (or during) the cartomizer filling process, at step S14, the controller 18 operates the marking mechanism 25 to print information from the print head 27 onto the side wall of the cartomizer held in the dispensing port 13. The controller 18 may operate the print head to print information relating to the dispensed e-liquid such as that listed above.

35 Once the cartomizer 19 has been filled with e-liquid and printed, the dispensing process finishes at step S15, and the user may then remove the cartomizer 19 from the dispensing port 13 and insert it into an electronic vapour inhalation device, such as an e-cigarette. The controller 18 may actuate an indicator 32, such as an LED, a message on a display screen, or an audible signal, to confirm that the
40 filling operation is complete and that a user may remove the filled cartomizer 19 from the dispensing

port 13, as part of the process end step S15. The LED, display screen or audible signal of the indicator 32 may be part of the overall user interface 17 or may be a separate component.

5 In an embodiment, the dispenser may be configured to receive and refill different configurations of cartomizers 19, for example, those of different e-cigarette manufacturers. The user could use the user interface 17 to select the type of cartomizer to be refilled and the memory 26 may store volume information for each known cartomizer so as to be able to dispense the correct measured volume of e-liquid into the cartomizer dependent on which cartomizer the user selected.

10 In an embodiment, it is intended that the vending machine 10 may be able to provide a blend of e-liquids contained in the respective reservoirs 12. This may be achieved by the controller 18 operating more than one of the supply valves 16 in the supply pipes 15 so that e-liquid is drawn from more than one reservoir 12 during the cartomizer filling process described above. The separate supply pipes 15 may combine at a manifold into a single supply duct 21 within the dispensing head 20, or alternatively,
15 the supply pipes 15 may terminate in separate respective supply ducts 21 within the dispensing head 20. The blend of e-liquids may be selected to provide e-liquids of, for example, varying nicotine content, flavour strength or flavour blends. The vending machine 10 may provide a user with a pre-programmed selection of e-liquid blends, the respective details of which may be stored in the memory 26, such as volume ratios of the liquids required from the each of the respective reservoirs 12 to
20 create the chosen blend. Alternatively, the vending machine may be operable to create a completely bespoke blend following a user's selection input via the user interface 17.

The vending machine 10 described above includes one dispensing port to receive cartomizers 19 to be filled with e-liquid. However, alternative embodiments may comprise a plurality of dispensing
25 ports, each configured to receive a different configuration of cartomizer 19. This would allow the vending machine to accept and refill cartomizers of a number of different manufacturers. In such an embodiment, each dispensing port may comprise a cartomizer sensor connected to the controller 18 so that the controller 18 can detect which dispensing port has a cartomizer 19 coupled thereto and control the dispensing head 20 in the correct dispensing port to perform a dispensing operation.
30 Again, the memory 26 may store volume information relating to a cartomizer associated with each dispensing port so that the correct volume of e-liquid is dispensed depending on which dispensing port a cartomizer is inserted into.

The vending machine 10 described above is configured to print information relating to the dispensed
35 e-liquid directly onto the cartomizer 19. However, in an alternative embodiment, the marking mechanism may print the relevant information on a separate label which may then be either automatically adhered to the cartomizer 19 whilst being held in the dispensing port 13 by a label applicator of the marking mechanism or, may be provided out of the vending machine 10 for a user to manually adhere to the cartomizer 19 once removed from the dispensing port 13.

40

In an embodiment, it may be desirable for cartomizers received in, and filled by, the vending machine 10, to include a seal such that once the cartomizer has been refilled the e-liquid is sealed within the cartomizer until the cartomizer is inserted into an e-cigarette. Such an embodiment is shown in Figure 5A and 5B, in which the cartomizer 19 comprises an elastomeric cover 33 over the opening in the top, and the supply duct 21 and vacuum duct 22 may terminate as syringe needles 21a, 22a which, when the cartomizer 19 is fitted into the dispensing port 13, pierce the elastomeric cover 33 to allow the e-liquid to be introduced into, and air evacuated from, the interior of the cartomizer 19. Once the cartomizer has been filled, the needles are retracted out of the cartomizer, and the resilience of the elastomeric cover 33 seals the needle holes, thereby sealing the cartomizer opening.

In an alternative embodiment, shown in Figures 6A and 6B, the cartomizer may be provided with connector 34 in its open end having one or more valves therein, which is configured to engage with, and be opened by, a corresponding coupling 35 in the dispensing head 20 when the cartomizer 19 is fitted within the dispensing port 13. Therefore, e-liquid may be introduced into the cartomizer through an open valve in the connector 34, and once filled, the cartomizer 19 is removed from the dispensing port 13, the valve in the connector 34 automatically closes, sealing the cartomizer 19. Furthermore, an e-cigarette into which the cartomizer may be intended to be inserted, may comprise a corresponding coupling to engage with the connector 34 to open the valve therein when the cartomizer is fitted within the e-cigarette.

In an embodiment, the vending machine 10 may be capable of wirelessly receiving a user's 'order' from a smart phone 36 or other portable electronic device via a receiver 37 within the vending machine 10 and connected to the controller 18. In such an embodiment, a suitable application may be loaded on the smart phone 36 which stores a user's previous or favoured e-liquid formulations, and a user may select a particular formulation on the smart phone 36 which is then transmitted to the receiver 37 of the vending machine 10 to initiate a dispensing operation as described above. In such an embodiment, payment may be able to also be made wirelessly for the vending operation via the smart phone 36 or other portable electronic device.

It will be appreciated that the vending machine 10 of the above-described embodiments provides regulated vending of e-liquids of known formulations and with a range of strengths and flavours which may be pre-made or may be bespoke mixtures created on-demand by individual users. Although in the embodiment of vending machine 10 described above, three reservoirs 12 are shown, in alternative embodiments, more reservoirs may be provided to enable a greater variety of bespoke e-liquid blends to be created and dispensed. Known e-cigarette liquids may comprise nicotine, flavourant and a dilutant. Dilutents may comprise Propylene Glycol, Vegetable Glycol or Aqueous Glycerine. The vending machine may include a single nicotine reservoir, a plurality of flavourant reservoirs and a plurality of dilutant reservoirs with different dilutents such as those listed above. The vending machine 10 may be configured to dispense a range of e-liquids within set-limits determined by a manufacturer or regulatory demands by combining different volumes of nicotine, flavourant and

diluent. For example, e-liquids with a nicotine content from zero to a maximum regulatory limit may be dispensed, with a range of user-selected flavours and concentrations. In order to provide a greater variety of e-liquid blends, the vending machine 10 may include a plurality of flow meters in the respective supply pipes 15 from each reservoir, all connected to the controller 18. The controller may
5 be able to control the supply valve 16 of each supply pipe 15 to close when a desired quantity of liquid from the respective reservoir 12 is dispensed, as detected by the respective flow meter and in accordance with the specific blend ratios of the e-liquid formulation selected by the user.

It is intended the embodiments of the vending machine 10 may comprise one or more mass flow
10 controllers, which may be part of the dispensing mechanism 14 or may be positioned within each of the supply pipes 15, to measure and control the flow rate of e-liquid therethrough. The or each mass flow controller may be connected to the controller 18. The mass flow controllers may generally comprise a mass flow sensor connected to a valve which the mass flow controller controls to maintain the flow rate at a desired level, the value of which may be received from the controller 18. Therefore,
15 a desired quantity of e-liquid can be accurately dispensed since the e-liquid flow rate is accurately controlled.

Figure 7 shows a first exemplary data flow diagram for the vending machine 10, and how the various data flows between the components of the machine and devices operable with the machine. The
20 wireless receiver 37 may be configured to receive data from a remote electronic device such as a smart phone 36, possibly via a dedicated app, relating to the user's order and selection of e-liquid to be dispensed, or e-liquid blend, and also to effect payment for use of the vending machine. The data may also comprise age verification data, such as date of birth or a registered user reference. This information is passed to the controller (which may comprise one or more processors). The vending
25 machine may additionally include a wireless transmitter such that the operation status and/or payment status of the user's order may be relayed to the portable device to be displayed to the user.

The user interface 17 may comprise a display unit, keypad and payment device 17a. The payment device may send payment instructions and signals to the controller 18. The keypad may be used to
30 select the desired e-liquid choice or blend and whether a new cartomizer 19 is required. The data may also comprise age verification data, such as date of birth or a registered user reference. Data relating to confirmation of the order, operational status and/or payment status may be transmitted to the display unit for display to the user.

35 The memory 26 may comprise RAM, ROM, a database and/or cache memory. It may store information relating to specific known cartomizer dimensions and volumes, to be accessed by the controller 18 during operation of the vending machine. It may also store current machine status data such as volumes of e-liquid in the respective reservoirs, which it may receive via the controller from level sensors in the reservoirs. The memory may also store all activity history of the vending machine
40 over a predetermined time period, such as number of cartomizers refilled, total volume of e-liquid

dispensed, a count of new cartomizers dispensed from the machine, and how many are remaining. It may also store information on users of the vending machine, including preferred choices, blends, user ID references, and frequency of use.

5 If the apparatus comprises one or more mass flow controllers, data relating to the desired flow rate, which may be stored in the memory for different cartomizer refilling processes, may be provided to the mass flow controller and data relating to the flow rate control, and total flow may be relayed back from the mass flow controller to the controller 18 and may be stored in the memory 26. Also, if the apparatus comprises one or more flow meters, data from these relating to the flow rate of e-liquid will
10 be fed to the controller 18, and may be stored in the memory 26.

It is intended that a plurality of vending machines 10 may be provided and connected to each other as a networked e-liquid vending machine system. In such a system, the various vending machines would be connected to a remote server, and real-time data may be collected from the vending
15 machines 10 within the network, analysed and stored on the server. The data collected could include type and volume of e-liquid dispensed and remaining reservoir levels in individual vending machines within the network, to enable an efficient maintenance schedule to be created so that vending machines within the network can have their reservoirs refilled before they are fully empty. The consumption levels of the different e-liquid formulations within the network of vending machines may
20 also be stored and analysed, including preferred blend ratios of e-liquids selected by users. The collected data could also relate to individual customer profiles, if available through a dispensing operation (e.g. from age/ID verification data input, or smart-phone connection via a personalised user account), for such data to be used for marketing purposes. This data may be transmitted to the server in real time or alternatively, may be stored in the memory 26 and transferred to the server at
25 regular intervals or on demand.

Figure 8 shows a second exemplary data flow diagram for the vending machine 10 and its data flow within a network of such vending machines and between a remote electronic device operable with the vending machine. Figure 9 shows an exemplary logic flow diagram for operation of the vending
30 machine 10 within a network of vending machines and in conjunction with a remote electronic device operable with the vending machine. Referring to Figure 8, in some implementations, a client 1100 such as a user's portable device may become "aware" of a nearby e-liquid vending machine (e.g., via "autohandshake," radio frequency identification (RFID), near-field communication (NFC), and/or the like) and generate an e-liquid vending options request, e.g., 1102, for example containing a security
35 certificate and/or credentials (e.g., username and password) to authenticate a user's identity, age, etc., along with user preference information stored on the client (e.g., preferred formulation(s), preferred flavour(s), cartomizer/device type, etc.) and/or user location information (e.g., GPS coordinates and/or the like). For example, the client 1100 may provide an e-liquid vending options request 1102 in the form of a (Secure) Hypertext Transfer Protocol ("HTTP(S)") POST message
40 including data formatted according to the eXtensible Markup Language ("XML"). An example e-liquid

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vending options request 1102, substantially in the form of a HTTP(S) POST message including XML-formatted data, is provided below:

```

5   POST /orderrequest.php HTTP/1.1
   Host: www.bat.com/e-liquid_dispense
   Content-Type: Application/XML
   Content-Length: 484
   <?XML version = "1.0" encoding = "UTF-8"?>
   <e-liquid_vending_options_request>
10      <request_ID>1126515</request_ID>
      <timestamp>yyyy-mm-dd hh:mmE-:ss</timestamp>
      <user_ID>jDoe@gmail.com</user_ID>
      <credentials>
15         <password>secret123</password>
         <access_key>Fort7992</access_key>
         <GPS_coord>Latitude_Longitude_Elevation</GPS_coord>
      <preference_details>
         <formulation_ID>150</formulation_ID>
         <flavor_ID>menthol</flavor_ID>
20         <cartomizer_type>100</cartomizer_type>
         <refill_amount>15mL</refill_amount>
         ...
      </preference_details>
      <client_details>
25         <client_IP>192.168.23.122</client_IP>
         <client_type>smartphone</client_type>
         <client_model>HTC Hero</client_model>
         <OS>Android 2.2</OS>
         <app_installed_flag>true</app_installed_flag>
30         ...
      </client_details>
   </e-liquid_vending_options_request>

```

35 In other embodiments, the e-liquid vending options request 1102 may be generated as a result of a user manually requesting, e.g., via a website or application running on the client 1100, information pertaining to nearby vending options for refilling his/her e-cigarette. The e-liquid vending options request 1102, in some embodiments, may be transmitted to a nearby e-liquid vending machine, e.g., 1200, or to multiple e-liquid vending machines via an e-liquid vending machine network.

40 The e-liquid vending machine may, in some embodiments, send an e-liquid user preferences request 1105 to an e-liquid vending server (e.g., 1121). In some implementations, the e-liquid vending server 1121 may receive a (Secure) Hypertext Transfer Protocol ("HTTP(S)") POST message including data formatted according to the eXtensible Markup Language ("XML"). An example e-liquid user preferences request 1104, substantially in the form of a HTTP(S) POST message including XML-formatted data, is provided below:

```

50  POST /sample_user_preference_query.php HTTP/1.1
   Host: www.bat.com/e-liquid_dispense
   Content-Type: Application/XML
   Content-Length: 484
   <?XML version = "1.0" encoding = "UTF-8"?>
   <sample_query_request>

```


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```

<request_ID>1126515</request_ID>
<timestamp>yyyy-mm-dd hh:mmE-:ss</timestamp>
<user_ID>JDoe@gmail.com</user_ID>
<credentials>
5     <password>secret123</password>
      <access_key>Fort7992</access_key>
      <GPS_coord>Latitude_Longitude_Elevation</GPS_coord>
<sample_user_preference_query name="e-liquid_user_profile">
      <query num=1>
10     Select CartomizerType.Number, Formulation.Pref from
      eLiquid_User_Profiles where UserAccountNum=JDoeAccountNum
      ...
      </query>
      <query>
15     ...
      </query>
    </sample_user_preference_query>
</sample_query_request>

```

20 The e-liquid vending server 1121 may perform the requested query (e.g., via user account preference query 1105) on user account database 1122 to determine user preference information (e.g., preferred formulation(s), preferred flavour(s), cartomizer/device type(s) owned/used, preferred filling location(s), etc.). The e-liquid vending server 1121 may, as a result of the query, return an e-liquid user preferences response 1107 to the e-liquid vending machine 1200.

25 The e-liquid vending machine may, at 1108, compile information obtained from one or both of the user client device and the user account database (e.g., via the e-liquid vending server 1121) in order to generate an e-liquid vending options response 1109 including one or more of the following: user authentication verification, location(s) of vending machine(s), formulation levels available within the machine(s), available flavourants, cartomizer/device types accommodated, payment methods
30 accepted, etc., and may display the available e-liquid vending options to the user, e.g., via client 1100 and/or via a user interface on the e-liquid vending machine 1200. A user may then choose to physically proceed to the location of the vending machine and complete the remainder of the e-liquid refill/purchase transaction via a user interface which is built into the vending machine itself.

35 Alternatively, a user may make a purchase/refill selection via his/her mobile device, e.g., at 1111 or 1112, from among the available e-liquid vending options, and an e-liquid order selection 1113/1114 may be sent to the e-liquid vending machine 1200. In some embodiments, a checkout page for completing the purchase/refill transaction may be transmitted from the e-liquid vending machine 1200 to the client 1100, e.g. presenting a variety of payment options from which the user may choose and
40 authorize via a payment election confirmation message 1117, while in other embodiments a user may complete and pay for a purchase/refill transaction via a user interface on the e-liquid vending machine 1200, for example via touch screen, keyboard, mouse, magnetic stripe reader, and/or the like.

45 The e-liquid vending machine 1200 may, at 1118, execute the e-liquid order fulfilment, for example by refilling e-liquid into an already-installed cartomizer/device, by dispensing an empty cartomizer/device to be refilled, by dispensing a pre-filled cartomizer/device, and/or by requesting (via a user interface

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on the e-liquid vending machine 1200 or via the client 1100) mechanical insertion of the cartomizer/device to be refilled on the front of the vending machine and subsequently refilling once insertion has been verified, etc. In some embodiments, the cartomizer/device may contain its own memory storage, from which case the e-liquid vending machine 1200 may retrieve information
5 relevant to the purchase/refill transaction, such as the model of the device, the age/usage history of the device, filling capacity, etc. The vending machine may further be capable, upon insertion of the device, of detecting a fill level within the device and/or properties of the formulation contained therein. The vending machine may further be equipped to indicate when the cartomizer/device refilling process has been completed, for example by rendering a message on the e-liquid vending machine
10 1200 user interface, transmitting a message (e.g., by rendering a webpage, sending an email message/SMS text) to a client 1100, emitting a tone, flashing a light, etc.

In one implementation, the order fulfilment may include generation of transaction data 1119 including, for example, the user's selected formulation type and quantity, cartomizer/device type, GPS-derived
15 location information, etc. An example of transaction data 1119 formatted in XML is provided below:

```
<order_fulfillment_transaction_data>  
  <request_ID>1126515</request_ID>  
  <timestamp>yyyy-mm-dd hh:mm:ss</timestamp>  
  <user_ID>jDoe@gmail.com</user_ID>  
  <formulation_ID>150</formulation_ID>  
  <flavor_ID>menthol</flavor_ID>  
  <cartomizer_type>100</cartomizer_type>  
  <refill_amount>15mL</refill_amount>  
25 </order_fulfillment_transaction_data>
```

Transaction data 1119 may, in some embodiments, be transmitted to the e-liquid vending server 1121 and/or to client 1100, for example as an addition/update to the record(s) contained therein (e.g., user account database 1121 and smart phone memory, respectively).
30

The logic flow diagram of Figure 9 illustrates the step-wise transactional process between a client 2100, the vending machine 2101 and the server 2102 of a network of vending machines. The respective steps of the logic flow diagram are explained within the logic step boxes of Figure 9 and so a detailed description of the respective steps in the process will not be repeated in detail here.
35

The housing 11 is intended to be a secure casing for the vending machine to resist being broken into or tampered with. As such, it is preferably made from a strong material such as steel, and includes a secure locking means so that only authorised personnel may access the interior of the vending machine 10. Furthermore, the housing 11 may include an alarm (not shown) that activates if the
40 housing 11 is interfered with or opened by an unauthorised person. Such alarm may be connected to the controller 18 and be configured to lock the dispensing function of the vending machine 10 until the alarm is reset. These tamper-resistant measures, plus the age-verification measures mentioned above, enhance the security of the vending machine 10. In addition, if the vending machine 10 or

housing 11 has been tampered with such that an alarm of the machine activates, this activation may be communicated to the server of the network so that appropriate servicing can be scheduled.

5 In an embodiment, the dispensing mechanism 14 may include a seal label applicator which is configured, upon completion of a dispensing operation, to apply a seal-label over the top of the filled cartomizer which is to be peeled off by a user before use in an inhalation device. Such a seal label may include tamper-evident features so that if the cartomizer is not for immediate use in an inhalation device, it will be apparent if the cartomizer has been interfered with since it was last filled.

10 The refilling of empty used cartomizers with e-liquid provides environmental benefits of reducing waste.

Although the embodiments described above have generally related to a vending machine, in the sense that some type of payment made be made in order to operate the machine, the approach
15 described herein may be utilised with a machine or apparatus for dispensing a vaporisable liquid that does not involve any form of vending or payment to the machine. One possibility, for example, is that the machine is located in an establishment (hotel, club, etc), where any payment is handled by a separate transaction, e.g. at a till. A user may then be permitted to use the machine, for example, by allowing the user to obtain physical access to the machine, by providing the user with some
20 appropriate token (e.g. key or smart card) that allows operation of the machine, by an operator sending a control instruction to the machine (by wired or wireless communication) to permit user operation, etc. The above approaches (and other potential mechanisms) may be used in combination with one another if so desired).

25 In some cases the machine may be maintained behind a counter, and is therefore operated on behalf of a user by an appropriate staff member of the establishment. The operator may have some appropriate token (e.g. password, key or smart card) that allows operation of the machine.

30 In some cases the machine may be provided as a home use apparatus, so that it can be located in a domestic setting. It may be more economical for a user to run such a home-use dispensing machine than to purchase individual e-cigarettes or individual cartridges (cartomisers) containing e-liquids for such devices. Furthermore, the machine 10 allows the e-liquid containers to become re-usable (rather than disposable) devices. In addition, the machine offers the user greater control over the content, e.g. flavouring, for any given container re-fill, rather than being limited to the particular
35 options available for individually purchased containers.

Such a home use apparatus will generally be smaller than a commercial vending machine, and typically will not incorporate any form of payment mechanism in the user interface 17. However, it may still have some appropriate access control facility, e.g. by a passcode, key or smart card, to help
40 prevent undesired usage of the machine. Such a home use apparatus may include the various

features of a dispensing machine described above in relation to Figures 1-9, as appropriate depending upon the particular circumstances of the apparatus.

5 In order to address various issues and advance the art, the entirety of this disclosure shows by way of illustration various embodiments in which the claimed invention(s) may be practiced and provide for superior liquid dispensers, methods and systems thereof. The advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and teach the claimed features. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other
10 aspects of the disclosure are not to be considered limitations on the disclosure as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope and/or spirit of the disclosure. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. In addition, the disclosure may
15 include other inventions not presently claimed, but which may be claimed in future.

20

Claims

1. A machine for dispensing a vaporisable liquid into a container for use in an electronic inhalation device, the machine comprising a reservoir for containing liquid, a dispensing port to
5 receive an empty container to be filled, a dispensing mechanism fluidly connected to the reservoir for dispensing a quantity of liquid from the reservoir to a container received in the dispensing port, a controller connected to the dispensing mechanism to control operation thereof, and a user-operable interface connected to the controller for a user to actuate the machine.
- 10 2. A machine according to claim 1 wherein the user-operable interface is operable by a user to affect payment for supply of a quantity of the liquid from the reservoir and the machine is configured to dispense a quantity of liquid from the reservoir in response to a payment operation by a user via the user-operable interface.
- 15 3. A machine according to claim 1 or claim 2 further comprising a magazine of empty liquid containers and a delivery mechanism configured to deliver an empty container from the magazine for subsequent insertion into the dispensing port and filling with liquid.
4. A machine according to claim 3 wherein the delivery mechanism is configured to delivery an
20 empty container from the magazine into the dispensing port.
5. A machine according to any preceding claim, further comprising a cleaning mechanism configured to clean a container received in the dispensing port prior to filling the container with liquid from the reservoir.
25
6. A machine according to claim 5 wherein the cleaning mechanism comprises an ultrasonic emitter.
7. A machine according to any preceding claim, wherein the dispensing port is configured to
30 receive and fill containers of varying configurations.
8. A machine according to any preceding claim comprising a plurality of dispensing ports configured to receive and fill containers having different configurations.
- 35 9. A machine according to any preceding claim comprising a plurality of reservoirs containing different liquids, wherein the dispensing mechanism is configured to selectively dispense liquid from the plurality of reservoirs to the dispensing port.

- 16 -

10. A machine according to claim 9 wherein the dispensing mechanism is configured to mix liquid from two or more of the plurality of reservoirs and dispense the mixed liquid to the dispensing port.

11. A machine according to claim 10 comprising at least three reservoirs respectively containing nicotine, a diluent, and a flavourant, and wherein the dispensing mechanism is configured to mix different ratios of the nicotine, diluent, and flavourant as the mixed liquid to be dispensed.

12. A machine according to any preceding claim further comprising a container marking mechanism configured to mark a container filled with liquid from the dispensing mechanism with information related to the dispensed liquid.

13. A machine according to claim 12 wherein the marking mechanism comprises a label printer configured to print a label with information relating to the dispensed liquid and adhere the label to the container.

14. A machine according to claim 12 wherein the marking mechanism comprises a printer configured to print information relating to the dispensed liquid directly onto the container.

15. A machine according to any preceding claim further comprising a container detector associated with the dispensing port and connected to the controller, and configured to detect whether a container is received within the dispensing port, and the controller is configured to control the dispensing mechanism not to dispense liquid if no container is received in the dispensing port.

16. A machine according to claim 15 wherein the container detector is configured to determine a type of container received within the dispensing port and the controller is configured to control the dispensing mechanism to dispense an appropriate amount of liquid in dependence on the detected container type.

17. A machine according to any preceding claim wherein the dispensing mechanism comprises a first duct configured to draw air out of the container to create a reduced pressure therein, and a second duct through which liquid from the reservoir is conveyed into the container and is drawn into the container by the vacuum created therein.

18. A machine according to any preceding claim wherein the dispensing mechanism comprises a flow meter connected to the controller and wherein the controller is configured to control the dispensing mechanism to dispense a pre-determined quantity of liquid as measured by the flow meter.

19. A machine according to claim 9 or any of claims 10 to 18 when dependent on claim 9, wherein each of the reservoirs is fluidly connected to the dispensing mechanism by a supply pipe, and

wherein each supply pipe includes a flow meter connected to the controller, and wherein the controller is configured to control the dispensing mechanism to dispense specific quantities of liquid from the reservoirs as measured by the flow meters.

- 5 20. A machine according to any preceding claim further comprising a wireless receiver connected to the controller and configured to receive a signal transmitted from a user-operated wireless device, and wherein the controller is configured to control the dispensing mechanism in response to the received signal.
- 10 21. A machine according to any preceding claim wherein the controller is configured only to control the dispensing mechanism to dispense liquid from the reservoir to a container upon verification of at least one user identification criterion.
- 15 22. A machine according to claim 21 wherein the controller is configured only to control the dispensing mechanism to dispense liquid from the reservoir to a container upon verification of minimum age information for a user.
- 20 23. A machine according to any preceding claim further comprising a seal label applicator configured to automatically apply a seal label over an opening in a container after being filled with liquid.
24. A machine according to claim 23 wherein the seal labels applied by the seal label applicator are tamper-evidencing seal labels.
- 25 25. A machine according to any preceding claim further comprising a memory unit connected to the controller.
- 30 26. A method of operating a machine for dispensing a vaporisable liquid into a container for use in an electronic inhalation device, the method comprising receiving a dispensing instruction via a user-operable interface connected to a controller, the controller actuating a dispensing mechanism to dispense a quantity of liquid from a reservoir of the machine to a dispensing port and into a container held in the dispensing port.
- 35 27. A method according to claim 26 comprising using the user-operable interface to affect payment for supply of a quantity of the liquid from the reservoir and dispensing a quantity of liquid from the reservoir in response to a payment operation.
28. A method according to claim 26 or claim 27 further comprising actuating of a delivery mechanism to deliver an empty container from a magazine of empty liquid containers for subsequent

insertion into the dispensing port and filling with liquid.

29. A method according to claim 28 wherein the delivery mechanism delivers an empty container from the magazine into the dispensing port.

5

30. A method according to any of claims 26 to 29, further comprising cleaning a container received in the dispensing port by actuation of a cleaning mechanism, prior to filling the container with liquid from the reservoir.

10

31. A method according to claim 30 comprising performing the cleaning operation by means of an ultrasound generating device.

32. A method according to any of claims 26 to 31, wherein the machine comprises a plurality of reservoirs containing different liquids, wherein the method comprises dispensing liquid from the plurality of reservoirs to the dispensing port according to a user selection.

15

33. A method according to claim 32 comprising mixing liquid from two or more of the plurality of reservoirs and dispensing the mixed liquid to the dispensing port.

20

34. A method according to claim 33 wherein the machine comprises at least three reservoirs respectively containing nicotine, a diluent, and a flavourant, and wherein the method comprises mixing different ratios of the nicotine, diluent, and flavourant as the mixed liquid to be dispensed.

25

35. A method according to any of claims 26 to 34 further comprising actuating a container marking mechanism to mark a container filled with liquid from the dispensing mechanism with information related to the dispensed liquid.

30

36. A method according to claim 35 wherein the marking mechanism comprises a label printer and the method comprises printing a label with information relating to the dispensed liquid for adherence onto the container.

37. A method according to claim 35 wherein the marking mechanism comprises a printer and the method comprises printing information relating to the dispensed liquid directly onto the container.

35

38. A method according to any of claims 26 to 37 wherein the machine further comprises a container detector associated with the dispensing port and connected to the controller, wherein the method comprises detecting whether a container is received within the dispensing port, and the controller controlling the dispensing mechanism not to dispense liquid if no container is received in the dispensing port.

40

39. A method according to claim 38 comprising determining a type of container received within the dispensing port and the controller controlling the dispensing mechanism to dispense an appropriate amount of liquid in dependence on the detected container type.
- 5 40. A method according to any of claims 26 to 39 wherein the dispensing mechanism comprises a first duct and a second duct fluidly connected between the reservoir and the dispensing mechanism, the method comprising drawing air out of the container through the first duct to create a reduced pressure therein, and conveying liquid from the reservoir into the container through the second duct by being drawn into the container by the vacuum created therein.
- 10 41. A method according to any of claims 26 to 40 wherein the dispensing mechanism comprises a flow meter connected to the controller and wherein the method comprises controlling the dispensing mechanism to dispense a pre-determined quantity of liquid as measured by the flow meter.
- 15 42. A method according to 32 or any of claims 33 to 41 when dependent on claim 32, wherein each of the reservoirs is fluidly connected to the dispensing mechanism by a supply pipe, and wherein each supply pipe includes a flow meter connected to the controller, the method comprising controlling the dispensing mechanism to dispense specific quantities of liquid from the reservoirs as measured by the flow meters.
- 20 43. A method according to any of claims 26 to 42 wherein the machine further comprises a wireless receiver connected to the controller, the method comprising receiving a signal transmitted from a user-operated wireless device, and the controller controlling the dispensing mechanism in response to the received signal.
- 25 44. A method according to any of claims 26 to 43 comprising verifying a user identification criterion and only dispensing liquid from the reservoir to a container upon verification of at least one user identification criterion.
- 30 45. A method according to claim 44 wherein the at least one user identification criterion verification comprises verification of minimum age information for a user.
46. A method according to any of claims 26 to 45 wherein the machine comprises a seal label applicator and the method comprises automatically applying a seal label over an opening in a
35 container after being filled with liquid.
47. A method according to any of claims 26 to 46 comprising applying tamper-evidencing seal labels to a container.
- 40 48. A machine according to any of claims 1 to 25, wherein said machine is a vending machine.

49. A method according to any of claims 26 to 47, wherein said machine is a vending machine.

50. A system of a plurality of machines according to any of claims 1 to 25 or 48 all connected to a
5 server, wherein each of the machines is configured to send data relating to the dispensing operations
of the respective machine to the server.

51. A system according to claim 50 wherein each machine within the system is configured to
transmit to the server data relating to the quantity of liquid dispensed from, or remaining in, the
10 machine reservoir(s).

52. A system according to claim 50 or claim 51 wherein each machine within the system is
configured to transmit to the server data relating to user selections of liquids to be dispensed.

15

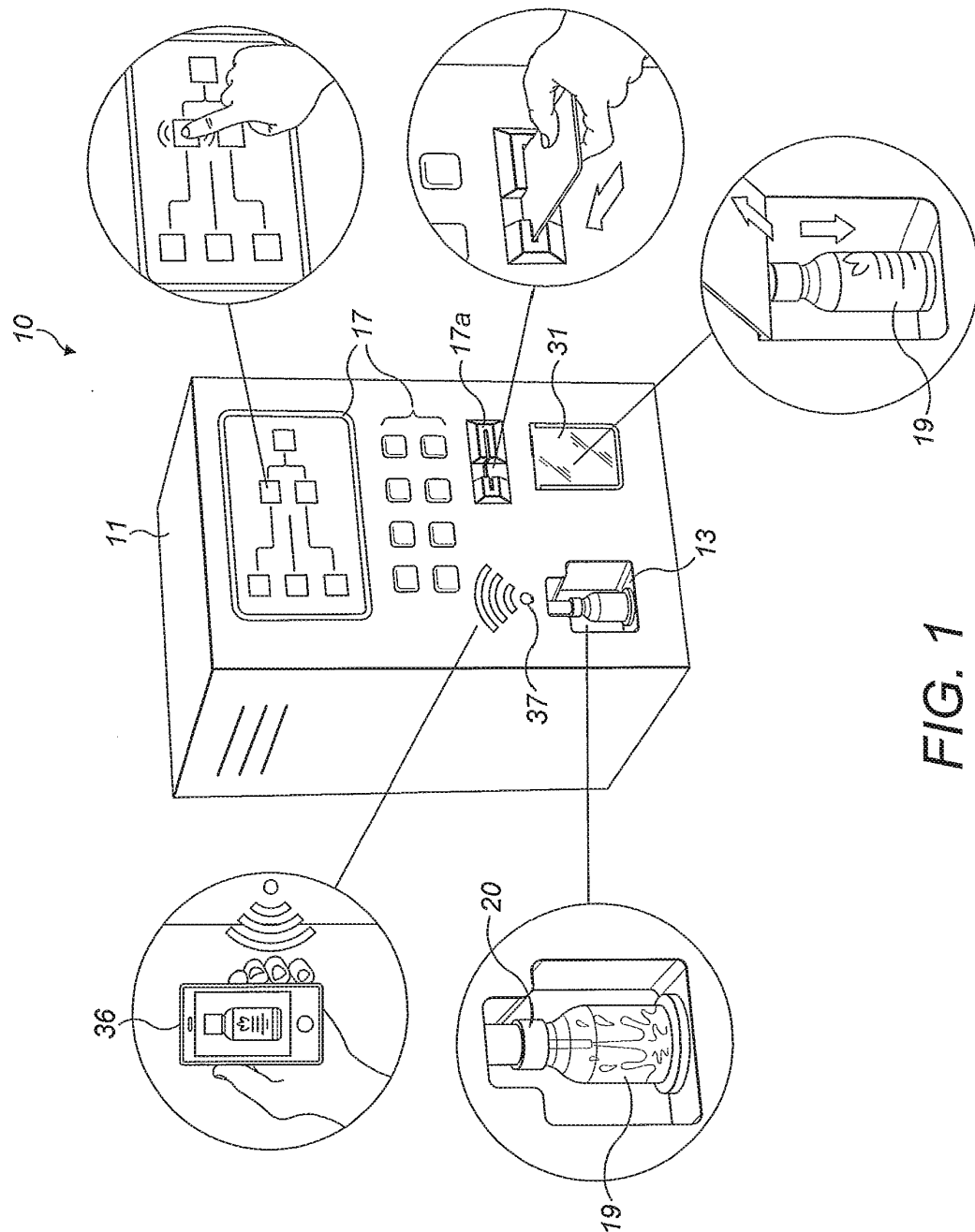


FIG. 1

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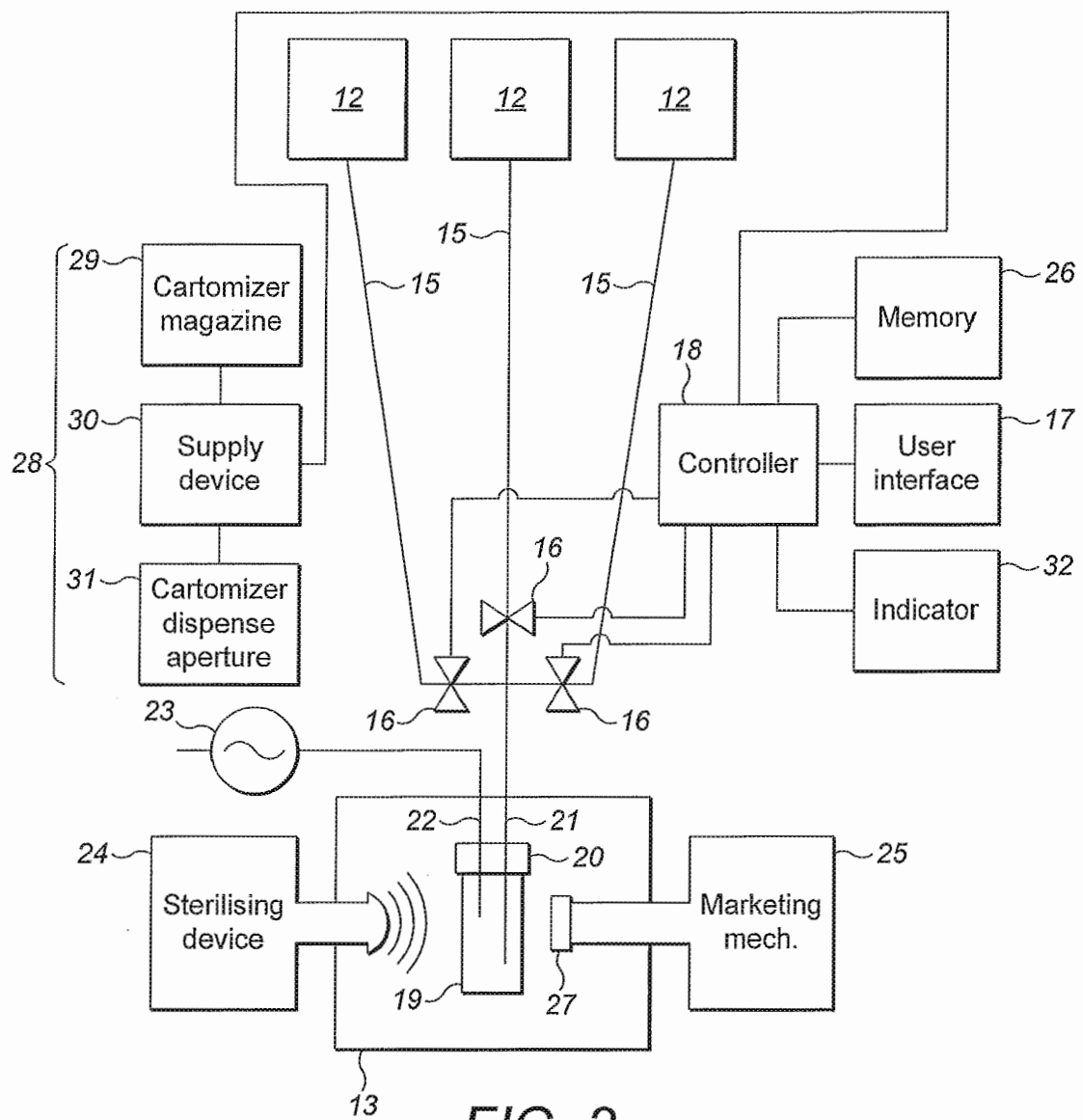


FIG. 2

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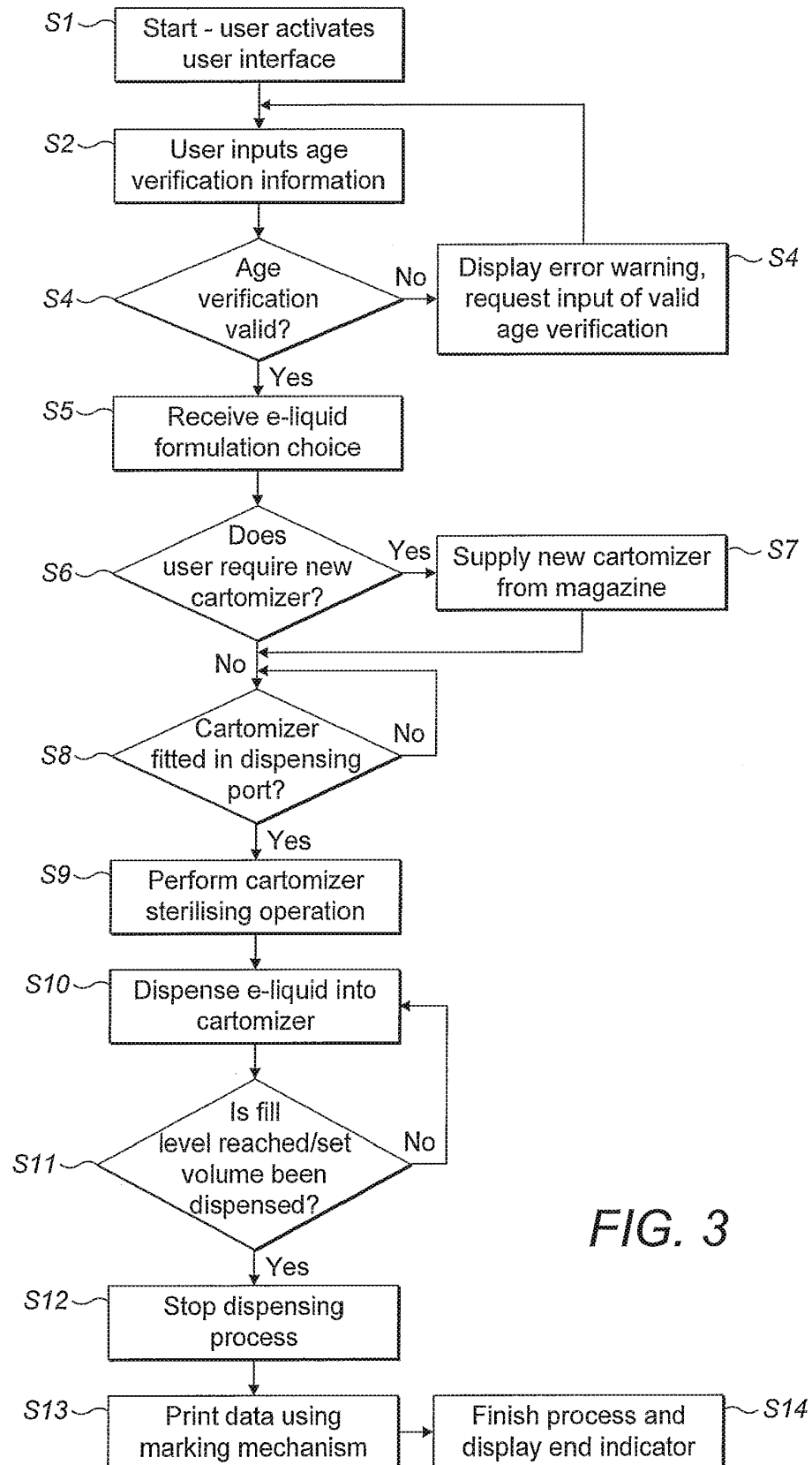


FIG. 3

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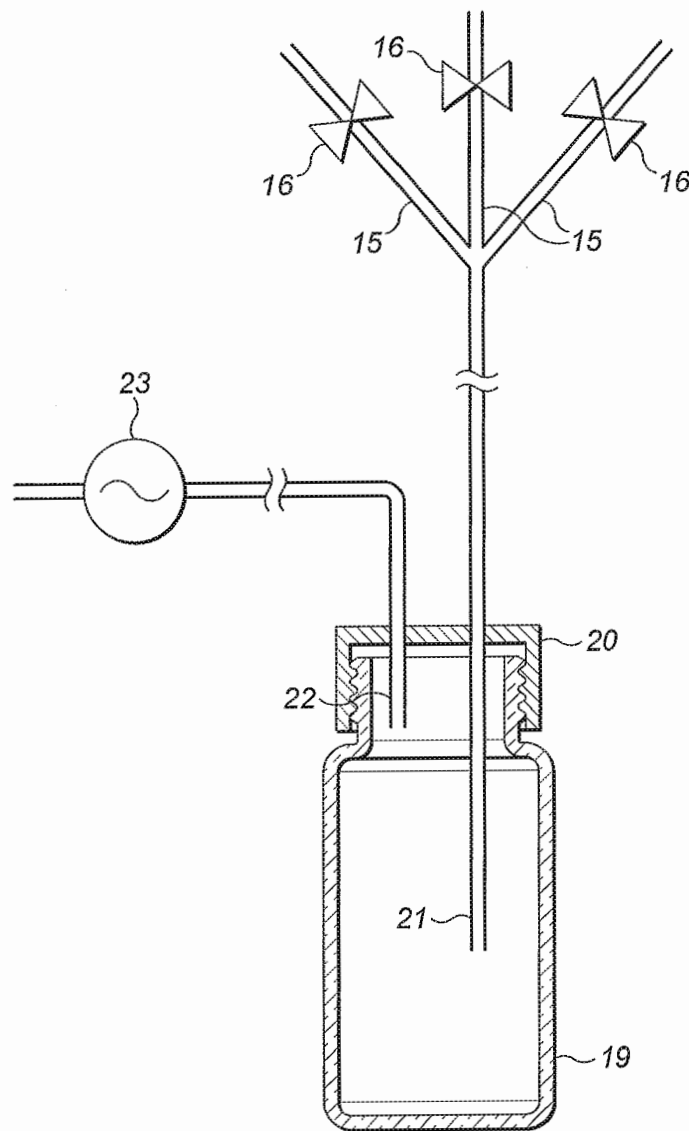


FIG. 4

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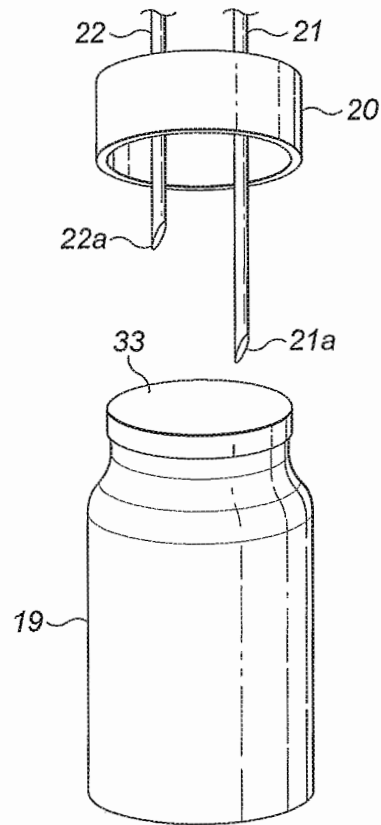


FIG. 5A

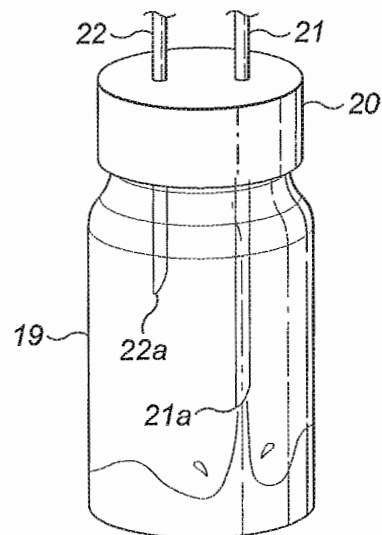


FIG. 5B

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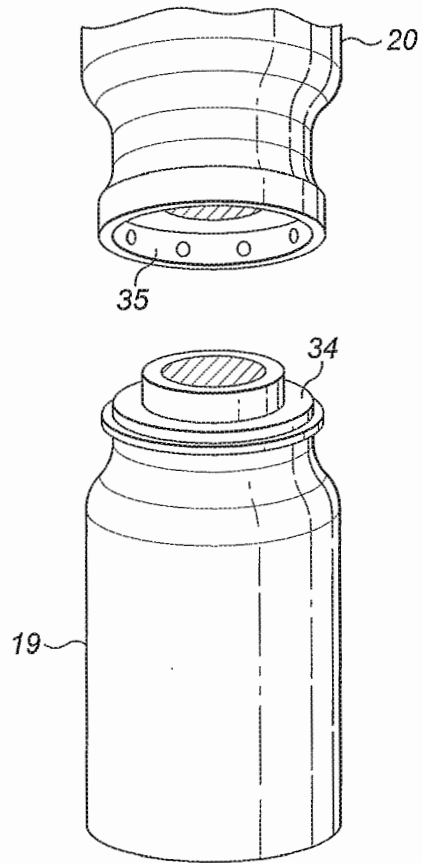


FIG. 6A

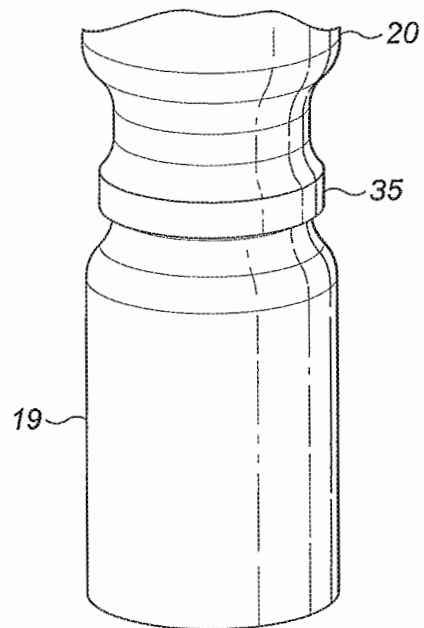


FIG. 6B

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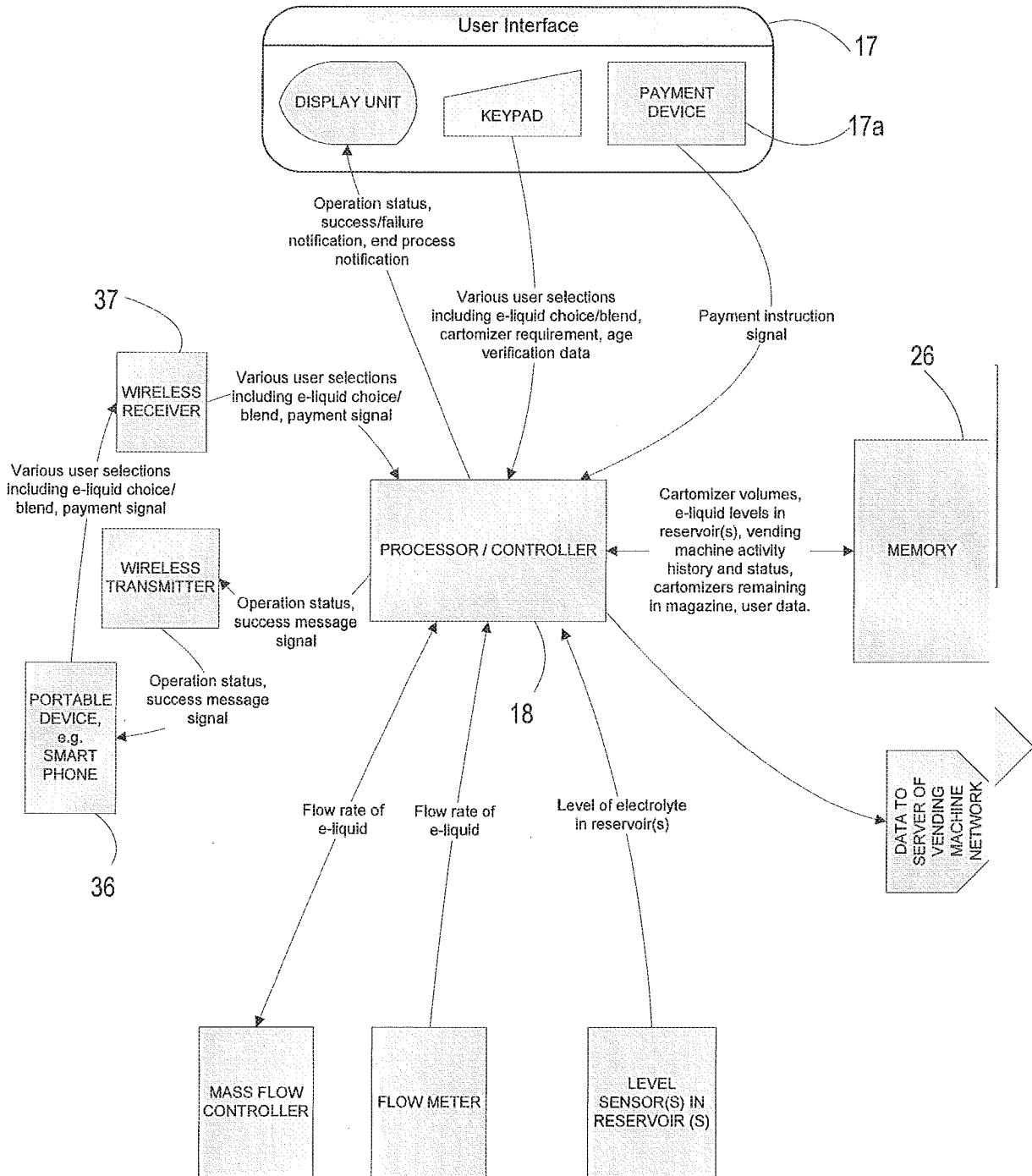


Fig. 7

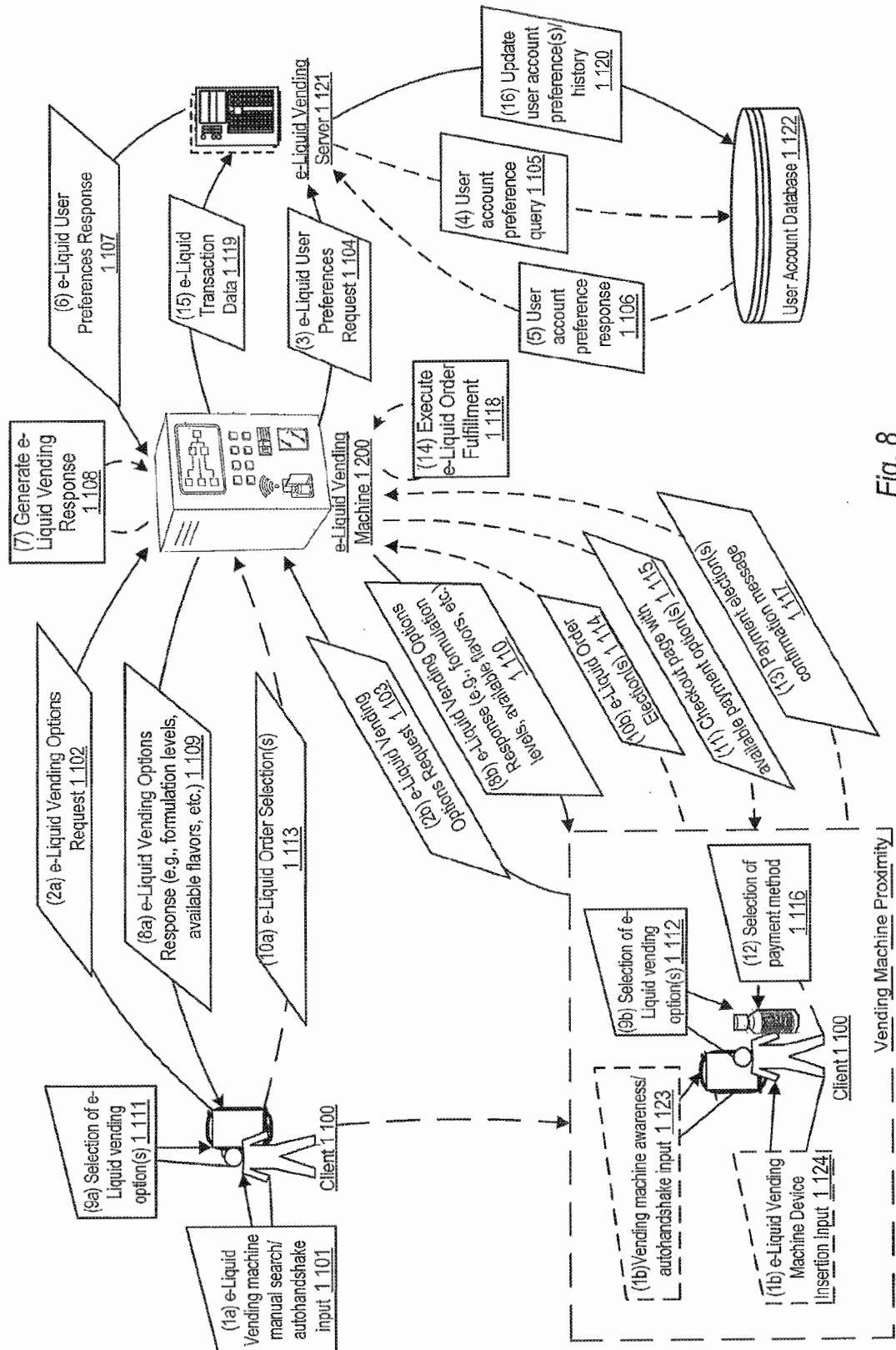


Fig. 8

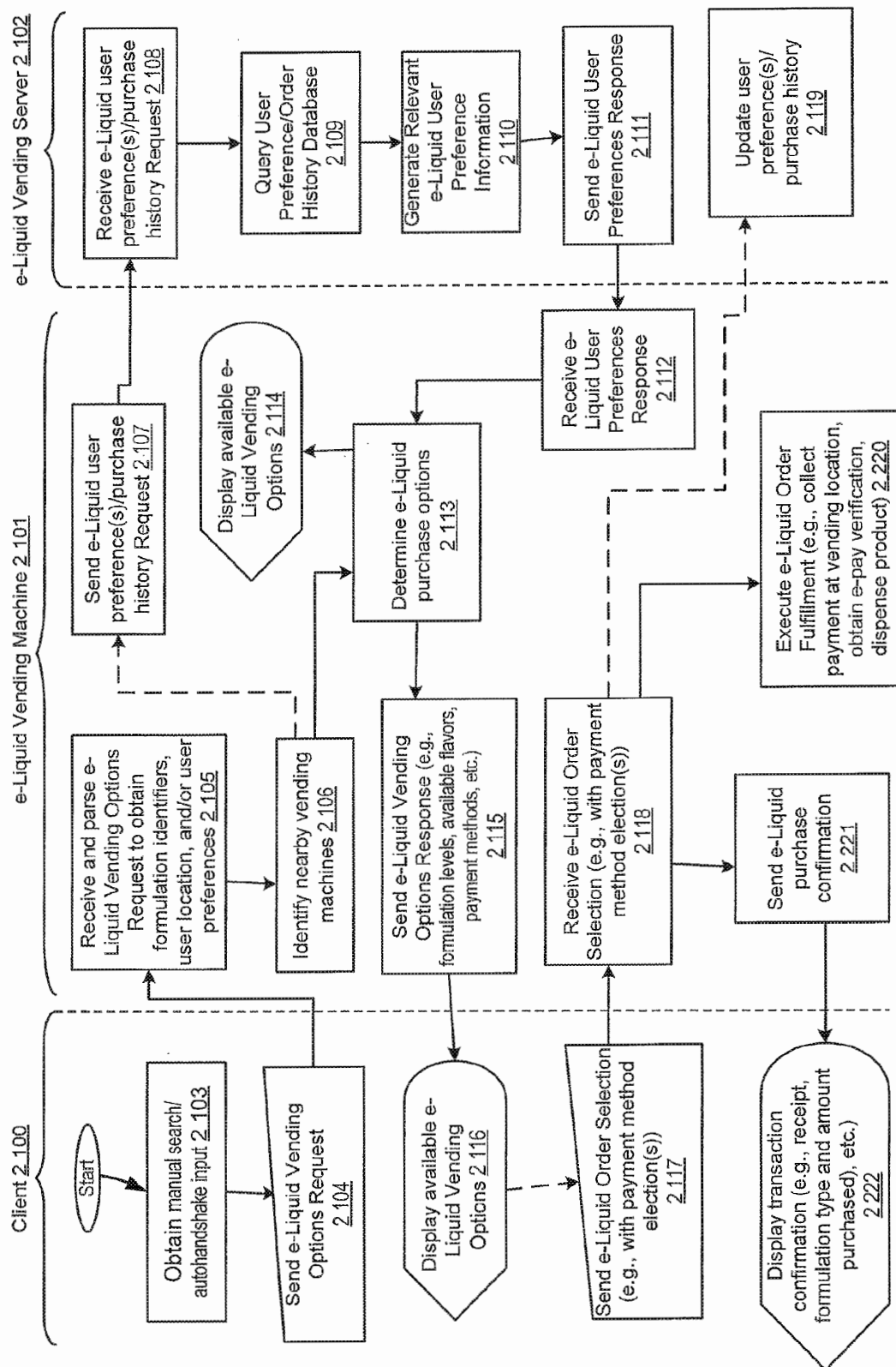


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2014/052626

A. CLASSIFICATION OF SUBJECT MATTER

INV. G07F13/02 G07F13/06 G07F13/10
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)

B01L G07F B65D A47J B67D A61J

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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/035761 A1 (TILTON DONALD EDWARD [US] ET AL) 9 February 2012 (2012-02-09) abstract; figures paragraph [0005] paragraphs [0027] - [0031] paragraph [0039] paragraphs [0042] - [0044] paragraph [0049] paragraphs [0053] - [0054] paragraphs [0059] - [0061] paragraphs [0063] - [0064] paragraphs [0068] - [0069] claims -----	1-52
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

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International application No
PCT/GB2014/052626

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No

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Published:

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(54) Title: ELECTRONIC VAPOUR PROVISION SYSTEM

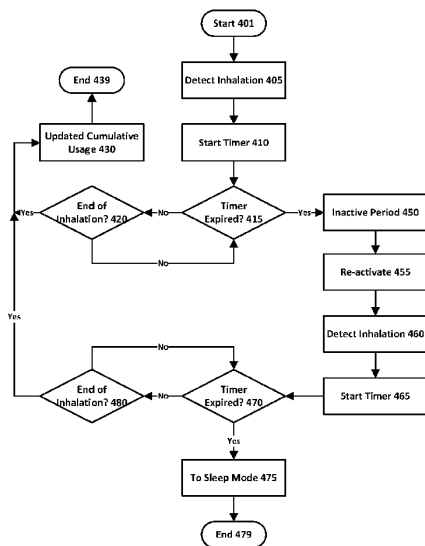


Figure 4

(57) Abstract: An electronic vapour provision system is provided including: a pressure drop or air flow sensor for monitoring inhalation by a user through the electronic vapour provision system; and a control unit for detecting the start and end of inhalation based on readings from the sensor. The control unit is configured to: monitor the cumulative period of inhalation (T_i) over a predetermined window (T_w); and transfer the electronic vapour provision system to a sleep mode if the cumulative period (T_i) exceeds a predetermined threshold (T_h).

WO 2015/052513 A2

ELECTRONIC VAPOUR PROVISION SYSTEM

Field

5 The present disclosure relates to electronic vapour provision systems such as electronic nicotine delivery systems (e.g. e-cigarettes).

Background

10 Electronic vapour provision systems such as e-cigarettes generally contain a reservoir of liquid which is to be vaporised, typically nicotine. When a user inhales on the device, a heater is activated to vaporise a small amount of liquid, which is therefore inhaled by the user.

 The use of e-cigarettes in the UK has grown rapidly, and it has been estimated that
15 there are now over a million people using them in the UK.

Summary

 The disclosure is defined in the appended claims.
20

 In one aspect, there is provided an electronic vapour provision system including:
 a pressure drop or air flow sensor for monitoring inhalation by a user through the electronic vapour provision system; and
 a control unit for detecting the start and end of inhalation based on readings from the
25 sensor;
 wherein the control unit is configured to:
 monitor the cumulative period of inhalation over a predetermined window; and
 transfer the electronic vapour provision system to a sleep mode if the cumulative
30 period exceeds a predetermined threshold.

 In one embodiment, the predetermined window represents a rolling window. In other words, the predetermined window represents the last 20, 25, 30, 45 seconds etc. depending on the period of the window.

 In one embodiment, upon entering sleep mode, one or more components of the
35 system must be disengaged and re-engaged to transfer the system from the sleep mode to a user mode (in which vapour can be inhaled). In one embodiment, the electronic vapour provision system comprises a vaporiser and a power supply whereby the vaporiser must be

disengaged and re-engaged with the power supply in order to re-enter user mode. This disengaging and re-engaging can be considered as a form of resetting the device.

In a further aspect, there is provided an electronic vapour provision system including:

5 a pressure drop or air flow sensor for monitoring inhalation by a user through the electronic vapour provision system; and

a control unit for detecting the start and end of inhalation based on readings from the sensor, wherein the control unit is configured to:

monitor the period of inhalation;

10 if the period of inhalation exceeds a first threshold:

render the electronic vapour provision system inactive for a predetermined period;

render the electronic vapour provision system active after the predetermined period has expired;

15 monitor the period of the next inhalation; and

if the period of the next inhalation exceeds a second threshold, transfer the electronic vapour provision system to a sleep mode.

In one embodiment, the system comprises a vaporiser for vaporising liquid for

20 inhalation by a user of the electronic vapour provision system and a power supply comprising a cell or battery for supplying power to the vaporiser. After a transfer to sleep mode, the system may be transferred back to a user mode (in which vapour can be inhaled), such that power is available to the vaporiser, by disengaging and re-engaging the vaporiser from the power supply. This disengaging and re-engaging can be considered as a form of

25 resetting the device.

The first threshold may be substantially the same period as the second threshold. Alternatively, the first threshold may be greater than the second threshold. Alternatively, the first threshold may be less than the second threshold.

The period of the first and/or the second threshold may be 3, 3.5, 4, 4.5 or 5

30 seconds. The period of the first and/or the second threshold may be from about 3 to 5 seconds, 3.5 to 5 seconds or 4 to 5 seconds. The period of the first and/or the second threshold may be greater than 3 seconds. Other embodiments may use different values for the first and/or second thresholds (which may be the same, or may differ from one another).

In one embodiment, the period of inactivity may be from 3 to 5 seconds. Other

35 embodiments may use different values for the period of inactivity, for example, depending on the desired configuration of the system.

In a further aspect, there is provided an electronic vapour provision system including:
a vaporiser for vaporising liquid for inhalation by a user of the electronic vapour provision system;

- a power supply comprising a cell or battery for supplying power to the vaporiser;
- 5 a power regulation system for compensating for variation in the voltage level of the power supplied to the vaporiser by the power supply using pulse-width modulation, thereby providing a more consistent output level of vaporised liquid for inhalation by the user.

In one embodiment, the power regulation system comprises a voltage reference generator, and the voltage level of the power supplied to the vaporiser is determined based on a comparison with the voltage from the voltage reference generator.

In one embodiment, the power regulation system comprises a voltage divider for dividing the voltage from the power supply prior to the comparison with the voltage from the voltage reference generator. The voltage divider may comprise a pair of resistors in series.

- 15 In one embodiment, the power regulation system is able to provide an approximately constant power level to the vaporiser.

In a further aspect, there is provided an electronic vapour provision system including:
a pressure drop or air flow sensor for monitoring inhalation by a user through the electronic vapour provision system; and

- 20 a control unit for detecting the start and end of inhalation based on readings from the sensor;

wherein the control unit is configured to:

- detect the start of inhalation when the sensor reading departs by more than a first threshold from a previous reading; and
- 25 detect the end of inhalation when the sensor reading departs by less than a second threshold from the previous reading;

wherein the first threshold is greater than the second threshold.

- 30 In one embodiment, the previous reading comprises an ambient value which is updated on a periodic basis. In one embodiment, upon detection of the start of inhalation, the control unit increases the rate at which a sensor reading is obtained. In one embodiment, upon detection of the start of inhalation, the control unit sets one or more timers to track the duration of this particular inhalation.

- 35 In one embodiment, the first threshold may be an absolute or relative difference with respect to the previous reading. For example, where the first threshold is an absolute difference with respect to the previous reading, the difference may be greater than 150, 200,

250, 300, 350, 400 or 450 Pascals. Alternatively, the difference may be in a range of from 150 to 450, 200 to 400, 250 to 350 or 300 to 350 Pascals. Where the first threshold is a percentage difference with respect to the previous reading, the percentage drop may be 0.2%, 0.3% or 0.4% compared with the previous reading. Other embodiments may use
5 different values for the absolute and/or relative difference, or may adopt a different strategy for setting the first threshold.

In one embodiment, the second threshold may be an absolute or relative difference with respect to the previous reading. For example, where the second threshold is an absolute difference with respect to the previous reading, the difference may be greater than
10 80, 100 or 120 Pascals. Alternatively, the difference may be in a range of from 20 to 250, 50 to 200, or 75 to 150 Pascals. Where the second threshold is a percentage difference with respect to the previous reading, the percentage drop may be 0.08%, 0.1% or 0.12% compared with the previous reading. Other embodiments may use different values for the absolute and/or relative difference, or may adopt a different strategy for setting the second
15 threshold.

In a further aspect, there is provided an electronic vapour provision system including:
a vaporiser for vaporising liquid for inhalation by a user of the electronic vapour provision system;
20 a power supply comprising a cell or battery for supplying power to the vaporiser; and
a control unit for controlling the supply of power from the power supply to the vaporiser, the control unit having a sleep mode where no power is supplied to the vaporiser and a user mode where power is available for supply to the vaporiser, whereby the control unit reverts from user mode to sleep mode after a predetermined amount of time of inactivity
25 in user mode and/or after the vaporiser has been disengaged from the power supply.

The period of inactivity may be varied depending on the desired configuration of the system. For example, the period of inactivity may be greater than 4, 5, or 6 minutes. Other embodiments may use different values for the period of inactivity, for example, depending on
30 the desired configuration of the system.

Where the system is transferred to sleep mode, it may be transferred back to user mode either by disengaging and re-engaging the vaporiser with the power supply, or by re-engaging the vaporiser with the power supply (if previously disengaged).

These and other aspects are apparent from the present disclosure as read as a
35 whole. Therefore, the disclosure is not to be restricted to specific paragraphs, but extends to combinations of the disclosures presented in the whole document. For example, an electronic vapour provision system may be provided in accordance with the present

disclosure which includes any one or more of the various aspects described above (or features therefrom).

Brief Description of the Drawings

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Figure 1 is a schematic (exploded) diagram of an e-cigarette in accordance with some embodiments of the disclosure.

Figure 2 is a schematic diagram of the main functional components of the body of the e-cigarette of Figure 1 in accordance with some embodiments of the disclosure.

10 Figure 3 is a schematic diagram showing various modes or states of the e-cigarette of Figures 1 and 2 in accordance with some embodiments of the disclosure.

Figure 4 is a flowchart illustrating a method for helping to protect against potential abuse of the device of Figures 1 and 2 in accordance with some embodiments of the disclosure.

15 Figure 5 is a flowchart illustrating a method detecting the start and end of inhalation in the device of Figure 1 and 2 in accordance with some embodiments of the disclosure.

Figure 6 is a schematic diagram of the power regulation system within the e-cigarette of Figures 1 and 2 in accordance with some embodiments of the disclosure.

20 Figure 7A illustrates how the power regulation system of Figure 6 changes the duty cycle to maintain a constant average power level in accordance with some embodiments of the disclosure.

Figure 7B is a schematic graph showing the variation of of duty cycle in relation to the measured or tracked voltage of the cell in accordance with some embodiments of the disclosure.

25

Detailed Description

As described above, the present disclosure relates to an electronic vapour provision system, such as an e-cigarette. Throughout the following description the term “e-cigarette” is used; however, this term may be used interchangeably with electronic vapour provision system.

30 Figure 1 is a schematic (exploded) diagram of an e-cigarette 10 in accordance with some embodiments of the disclosure (not to scale). The e-cigarette comprises a body 20, a cartridge 30 and a vaporiser 40. The cartridge includes an internal chamber containing a reservoir of nicotine and a mouthpiece 35. The cartridge reservoir may be a foam matrix or any other structure for retaining the nicotine until such time that it is required to be delivered to the vaporiser. The body 20 includes a re-chargeable cell or battery to provide power to

the e-cigarette 10 and a circuit board for generally controlling the e-cigarette. The vaporiser 40 includes a heater for vaporising the nicotine and further includes a wick or similar device which transports a small amount of nicotine from the reservoir in the cartridge to a heating location on or adjacent the heater. When the heater receives power from the battery, as
5 controlled by the circuit board, the heater vaporises the nicotine from the wick and this vapour is then inhaled by a user through the mouthpiece.

The body 20 and the vaporiser 40 are detachable from one another, but are joined together when the device 10 is in use, for example, by a screw or bayonet fitting (indicated schematically in Figure 1 as 41A and 21A). The connection between the body and vaporiser
10 provides for mechanical and electrical connectivity between the two. When the body is detached from the vaporiser, the electrical connection 21A on the body that is used to connect to the vaporiser also serves as a socket for connecting a charging device (not shown). The other end of the charging device can be plugged into a USB socket to re-charge the cell in the body of the e-cigarette. In other implementations, the e-cigarette may
15 be provided with a cable for direction connection between the electrical connection 21A and a USB socket.

The body is provided with one or more holes (not shown in Figure 1) for air inlet. These holes connect to an air passage through the body to an air outlet provided as part of connector 21A. This then links to an air path through the vaporiser 40 and the cartridge 30
20 to the mouthpiece 35. The cartridge 30 and the vaporiser 40 are attached in use by connectors 41B and 31B (again shown schematically in Figure 1). As explained above, the cartridge includes a chamber containing a reservoir of nicotine, and a mouthpiece. When a user inhales through the mouthpiece 35, air is drawn into the body 20 through one or more air inlet holes. This airflow (or the resulting change in pressure) is detected by a pressure
25 sensor, which in turn activates the heater to vaporise the nicotine from the cartridge. The airflow passes from the body, through the vaporiser, where it combines with the nicotine vapour, and this combination of airflow and nicotine vapour then passes through the cartridge and out of the mouthpiece 35 to be inhaled by a user. The cartridge 30 may be detached from the vaporiser 40 and disposed of when the supply of nicotine is exhausted
30 (and then replaced with another cartridge).

It will be appreciated that the e-cigarette 10 shown in Figure 1 is presented by way of example, and various other implementations can be adopted. For example, in some embodiments, the cartridge 30 and the vaporiser 40 may be provided as a single unit (generally referred to as a cartomiser), and the charging facility may connect to an additional
35 or alternative power source, such as a car cigarette lighter.

Figure 2 is a schematic diagram of the main functional components of the body 20 of the e-cigarette 10 of Figure 1 in accordance with some embodiments of the disclosure.

These components may be mounted on the circuit board provided within the body 20, although depending on the particular configuration, in some embodiments, one or more of the components may instead be accommodated in the body to operate in conjunction with the circuit board, but is/are not physically mounted on the circuit board itself.

5 The body 20 includes a sensor unit 60 located in or adjacent to the air path through the body 20 from the air inlet to the air outlet (to the vaporiser). The sensor unit includes a pressure sensor 62 and temperature sensor 63 (also in or adjacent to this air path). The body further includes a Hall effect sensor 52, a voltage reference generator 56, a small speaker 58, and an electrical socket or connector 21A for connecting to the vaporiser 40 or
10 to a USB charging device.

 The microcontroller 55 includes a CPU 50. The operations of the CPU 50 and other electronic components, such as the pressure sensor 62, are generally controlled at least in part by software programs running on the CPU (or other component). Such software programs may be stored in non-volatile memory, such as ROM, which can be integrated into
15 the microcontroller 55 itself, or provided as a separate component. The CPU may access the ROM to load and execute individual software programs as and when required. The microcontroller 55 also contains appropriate communications interfaces (and control software) for communicating as appropriate with other devices in the body 10, such as the pressure sensor 62.

20 The CPU controls the speaker 58 to produce audio output to reflect conditions or states within the e-cigarette, such as a low battery warning. Different signals for signalling different states or conditions may be provided by utilising tones or beeps of different pitch and/or duration, and/or by providing multiple such beeps or tones.

 As noted above, the e-cigarette 10 provides an air path from the air inlet through the
25 e-cigarette, past the pressure sensor 62 and the heater (in the vaporiser), to the mouthpiece 35. Thus when a user inhales on the mouthpiece of the e-cigarette, the CPU 50 detects such inhalation based on information from the pressure sensor. In response to such a detection, the CPU supplies power from the battery or cell 54 to the heater, which thereby heats and vaporises the nicotine from the wick for inhalation by the user.

30 Figure 3 is a schematic diagram showing various modes or states of the e-cigarette 10 of Figures 1 and 2 in accordance with some embodiments of the disclosure. The device has three modes, namely shelf mode 301, sleep mode 302, and user mode 303. One motivation for the different modes is to help extend cell lifetime – thus shelf mode uses less power from the battery than sleep mode, which in turn uses less power from the cell than
35 user mode. The Hall sensor 52 is responsible for switching from shelf mode to sleep mode, while the CPU 50 is generally responsible for switching the device between sleep mode and

user mode (and vice versa) according to predefined triggers. These changes in state may be confirmed by appropriate beeps or tones from the speaker 58.

The device is in shelf mode when in its original packaging (not shown) – hence it remains in shelf mode prior to purchase by a consumer (end user). In shelf mode, the device is largely inactive apart from the Hall effect sensor 52, which draws a very small current (approximately 3µAmp in some implementations). Since the cell 54 generally has a capacity of over 100 mAmp hours, the device can remain powered in shelf mode for up to four years or more.

The packaging is arranged to have a magnet located close to the Hall sensor. When the device is removed from the packaging, the Hall sensor detects the change (reduction) in magnetic field arising as the device is distanced from the magnet. In one embodiment, the Hall sensor 52 responds to this change by providing power to the microcontroller 55, which then becomes operational. This has the effect of switching the device from shelf mode 301 into sleep mode 302. Note that once the device has switched out of shelf mode, it may be possible for the device to be returned to shelf mode if it is placed back in the packaging containing the magnet, depending upon the particular implementation.

The body further includes a capacitor (not shown in Figure 2) which is electrically connected to the electrical socket or connector 21A. In the original packaging, the vaporiser 40 is detached from the body 20. In this configuration, with the body 20 not attached to the vaporiser (or the USB charging device), the electrical socket 21A presents an open circuit to the capacitor, which therefore maintains its charge for a relatively substantial period of time. However, if the vaporiser 40 is connected to the electrical socket 21A, this presents a conductive path through which the capacitor is able to discharge very quickly.

When a user wishes to operate the device, the vaporiser is joined to the body. Every two seconds in sleep mode the CPU arranges for the capacitor to be charged up. If the capacitor discharges rapidly (in just a small fraction of a second), the CPU determines that the body is now connected to the vaporiser. This triggers the CPU to switch the device from sleep mode 302 to user mode 303. Alternatively, if the capacitor does not discharge within a predetermined time (much less than two seconds), this indicates that the body is still separated from the vaporiser, and hence the user is not able to operate the device. Accordingly, in this latter case, the CPU maintains the device in sleep mode, and waits for another two second interval before charging up the capacitor again to test for any new connectivity to the vaporiser.

It will be appreciated that the two second interval is a balance between (i) not charging the capacitor too frequently, which would reduce battery lifetime, and (ii) ensuring that if a user does prepare the device for use (by connecting the vaporiser to the body), then the device is active by the time the user inhales to provide the vaporised nicotine. In other

implementations, a different interval may be adopted, depending upon the properties and intended usage pattern of the device in question.

There are various routes or triggers for the CPU 50 to switch the device back from user mode 303 to sleep mode 302. One trigger is if the user disengages the vaporiser 40 from the body 20 – this would typically indicate that the user has finished using the e-cigarette 10 for the time being. Another trigger is if the user has not inhaled for a predetermined time, such as five minutes (see below for a description of how such inhalation is detected). This helps to ensure that the device is not left in an active state for too long, for example, in a situation in which a user becomes distracted while using the device, and moves away to do something else without separating the body from the vaporiser. If the CPU does transition the device to sleep mode 302 while the vaporiser is still connected to the body, then in order to return to user mode 303, a user must first disengage the vaporiser from the body and then re-engage the vaporiser with the body. (This can be regarded as a form of resetting the device). Placing the device in sleep mode if it has been inactive for this predetermined period of time also helps to reduce power consumption, as well as to restrict usage of the device by unintended parties.

Further triggers for switching from user mode 303 to sleep mode 302 are provided to help prevent potential abuse of the device. One such trigger monitors the total period of inhalation (say T_i) within a given window (of duration say T_w). If the value of T_i is seen to be unusually large, then the CPU transitions the device to sleep mode. In some implementations, T_w is fixed, for example at 30 second, 40 or 50 seconds. If the total cumulative period of inhalation (T_i) then exceeds a given threshold (T_h) (say 10 or 20 seconds) during this window, the sleep mode is triggered. For example, the device might transition to sleep mode if the period of inhalation (T_i) within the last 40 seconds (representing the window, T_w) exceeds the threshold (T_h) of 15 seconds.

One way of viewing this trigger is that it monitors an average level of usage (T_i/T_w) by assessing cumulative usage over a period corresponding to multiple inhalations (puffs) of the device, and signals a potential abuse if this average exceeds a given threshold (T_h/T_w). It will be appreciated that other implementations may adopt different approaches for determining whether the average or cumulative level of usage represents a potential abuse, and for triggering accordingly.

Another trigger for helping to protect against potential abuse of the device in some embodiments is illustrated by the flowchart of Figure 4. The processing, which is generally managed by the CPU 50, commences with detection of the start of inhalation (405), which starts a timer running from zero (410). The CPU now waits for one of two potential inputs: (a) detecting the end of inhalation (420); or (b) the timer reaching a first predefined threshold (410)(say 3, 3.5 or 4 seconds). If the end of the inhalation occurs before the timer reaches

the threshold, then processing terminates with no further action (439), apart from updating the cumulative usage information (430). In this case, the processing for the next inhalation will commence again at the start (401) of the flowchart of Figure 4.

However, if the timer reaches the first predefined threshold before detecting the end
5 of the inhalation, then the CPU automatically shuts off the supply of nicotine vapour by cutting power to the heater. This prevents the user from inhaling further nicotine vapour from the device. The CPU also restarts the timer to wait for a second predefined interval or delay (which may be the same as the first predefined threshold), say 3, 3.5 or 4 seconds. During this time, the CPU maintains the device effectively in an inactive state (450), in that
10 even if the user inhales, this does not trigger the production of nicotine vapour (unlike normal operation of the device). After the time period corresponding to the predefined interval has passed, the CPU in effect re-activates the device (455), so that now normal operation is resumed, in that if the user inhales, this does trigger the CPU to switch on the heater to produce nicotine vapour. However, in response to detecting such a further inhalation (460),
15 the CPU starts the timer again (465), and determines (470) whether the duration of this further inhalation exceeds a second predefined threshold (which may be the same as the first predefined threshold), say 3, 3.5 or 4 seconds. This determination is analogous to the situation with the first inhalation, in that the CPU is waiting to see which occurs first – the end of the inhalation (480) or the timer reaching the second predefined threshold (470). If the
20 former occurs first, the duration of the further inhalation is within the second predefined threshold. In this case, processing terminates with no further action, apart from updating the cumulative usage (430), and the processing for the next inhalation will commence again at the start of the flowchart of Figure 4.

However, if the timer reaches the second predefined threshold prior to the end of the
25 inhalation, then this is regarded as a further indication of abuse, since there have now been two successive inhalations which exceed their respective thresholds. In this situation, the CPU returns the device to sleep mode (475). It will be appreciated that in this situation, further operation of the device is prevented until the device has been returned to user mode by disengaging the vaporiser 40 from the body 20 and then re-engaging the vaporiser with
30 the body.

The processing of Figure 4 helps to protect against potential abuse of the device in accordance with a two-tier approach, in that there is one sanction against an excessive duration for a single inhalation (an enforced period of inactivity corresponding to the second, predefined interval before the device can be used again), and a further sanction if the first
35 inhalation of excessive duration is then followed directly by a second inhalation of excessive duration (namely, an enforced requirement to separate and re-join the vaporiser and the body before the device can be used again).

In some embodiments, the operations of Figure 4 not only may help to prevent potential abuse of the device, but they also may help to protect against over-heating by generally limiting the period for which the CPU 50 provides continuous power to the heater to no more than the first predefined threshold. Such over-heating might otherwise potentially occur, for example, if the device failed to detect the end of an inhalation by a user, or if the device was placed in an environment that somehow simulated a prolonged inhalation.

Figure 5 is a flowchart illustrating a method for the device of Figures 1 and 2 to detect the start and end of an inhalation in accordance with some embodiments of the disclosure. This method is initiated (501) when the device enters into user mode. The CPU obtains a pressure reading (510) from the pressure sensor multiple (e.g. 5, 8, 9, 10 or 12) times per second. In some implementations, the pressure sensor and the temperature sensor are provided in a single combined unit (integrated circuit device) - this allows the pressure sensor to adjust the pressure reading to a constant temperature value, thereby removing (at least reducing) pressure variations caused by fluctuations in temperature in the pressure readings supplied to the CPU. In other implementations, the pressure and temperature readings may be provided separately to the CPU, which performs its own adjustment or correction of the pressure readings to accommodate any changes in temperature. Other implementations might not have a temperature sensor, in which case the pressure readings would be used directly, without compensation for any variation in temperature.

After the first pressure reading has been acquired, this is saved as an ambient pressure value (515). The CPU also starts a timer T1 (520) which expires after a predetermined time period, say 2, 3 or 4 seconds. The CPU now waits for one of two events. The first event is expiry of the timer (535). In this case, the CPU updates the ambient pressure value (530) to match the most recent pressure reading, resets the timer (520), and repeats the process. Accordingly, absent any other activity, the CPU updates the ambient pressure on a regular basis corresponding to said predetermined time period of the timer T1. In addition, the CPU also compares each newly detected pressure reading (which continue to be obtained (540)) with the current value stored for the ambient pressure (545). If the new pressure reading is below the stored value for the ambient pressure by more than a first predefined amount (threshold TH1), this triggers the second event, namely detection of the start of inhalation (550). Note that the first predefined amount (threshold TH1) may be specified as an absolute or relative difference with respect to the ambient pressure. For example, depending on the particular device, the first predefined amount might be a drop in pressure of (one of) 200, 300 or 400 Pascals, or a percentage drop of 0.2%, 0.3% or 0.4% compared with the (stored) ambient value.

In one implementation, whenever the ambient pressure value is updated at operation 530, the system determines a first trigger pressure value based on the ambient pressure

value minus the first predefined amount (threshold TH1). The test at operation 545 to detect the start of inhalation can then check whether the pressure detected at operation 540 is below this first trigger pressure value. If so, the detected pressure represents a drop in pressure greater than the threshold TH1, thereby leading to a positive outcome from operation 545, corresponding to the start of inhalation. One advantage of this approach is that a direct comparison between the detected pressure and the first trigger pressure can be performed quickly and easily to detect the start of inhalation. Other implementations may adopt a different approach to perform this detection, although the end result is the same. For example, each detected pressure might first be subtracted from the current ambient pressure, and the onset of inhalation would then be detected if the result of this subtraction is greater than the threshold T1.

Assuming that the drop in pressure from the current ambient value exceeds the first predefined amount (TH1) at operation 545, the CPU determines that inhalation has commenced. The CPU then supplies power to the vaporiser to vaporise nicotine from the wick into the airflow caused by the inhalation. In addition, the CPU increases the rate at which a pressure sensor reading is obtained (575), say to 20-30 times per second, and sets one or more timers to perform the monitoring described above (see Figure 4) to track both the duration of this particular inhalation, and also to update the cumulate level of usage over the specified window (Tw). The CPU also continues to update the ambient pressure value 565 whenever the timer T1 expires, and to reset this timer as appropriate (570).

The CPU determines that inhalation has terminated (580) when the pressure sensor reading returns to within a second predefined amount (threshold TH2) from the currently stored ambient pressure value. Similar to the first predefined amount (TH1), the second predefined amount (TH2) may be specified as an absolute or relative difference with respect to the ambient pressure. For example, depending on the particular device, the second predefined amount might be a drop in pressure of (one of) 80, 100 or 120 Pascals, or a percentage drop of 0.08%, 0.1% or 0.12%. Similar to the first predefined amount (TH1), in some implementations, whenever the ambient pressure value is updated at operation 530, the system may determine a second trigger pressure value based on the ambient pressure value minus the second predefined amount (threshold TH2). The test at operation 580 to detect the start of inhalation can then check whether the pressure detected at operation 575 has now risen to be greater than this second trigger pressure value. If so, the detected pressure represents a drop in pressure which is now less than the threshold TH2, thereby leading to a positive outcome from operation 580, representing the end of inhalation. Once the termination of inhalation has been determined (585), the CPU can switch off power to the heater, and reset any timers used in the monitoring processes described above.

Having two separate thresholds (TH1, TH2) for determining (i) the start of inhalation, and (ii) the end of inhalation provides greater flexibility and reliability than just having a single threshold for determining whether or not inhalation is currently in progress. In particular, the threshold for detecting the start of inhalation can be raised somewhat (corresponding to a greater pressure drop from ambient). This helps to provide improved robustness in the detection of inhalation (as opposed, for example, to undesired triggering with respect to changes in environmental conditions, which would then lead to unnecessary heating, and hence consumption of power from the cell and nicotine from the reservoir). Similarly, having a lower threshold for detecting the end of inhalation (a smaller pressure drop from ambient) helps to provide a better measurement of the actual length of inhalation, which is useful for monitoring against potential abuse of the device as described above. For example, it has been found that the latter part of a draw (inhalation) tends to produce a lower pressure drop from ambient, hence if the second threshold (TH2) were not reduced compared with the first threshold (TH1) (corresponding to a lesser pressure drop from ambient), the device would tend to determine that inhalation had terminated while the user was, in fact, still drawing on the device, albeit at a lower level to create a smaller pressure drop.

As illustrated in Figure 2, the e-cigarette 10 of Figures 1 and 2 is powered by a re-chargeable cell 54. In practice, the voltage output of such cells tends to decline as they discharge, for example, from about 4.2V when fully charged, down to about 3.6V just before being fully discharged. Since the power output across a given heating resistor R goes with V^2/R , this implies that there would generally be a corresponding drop in power output such that the final operational power output (at a voltage of 3.6V) is only 73% of the initial power output (at a voltage of 4.2V). This change in power supplied by the cell 54 to the heater in the vaporiser 40 may impact the amount of nicotine vaporised (and hence inhaled by a user).

Figure 6 is a schematic depiction of a part of the power regulation system for the e-cigarette of Figures 1 and 2 in accordance with some embodiments of the disclosure. The power regulation system includes a voltage reference device 56, which provides a consistent (known) output voltage level (V_r), irrespective of variations in the output voltage (V_c) of the re-chargeable cell 54. The power regulation system further comprises a voltage divider comprising two resistors, R1, R2, which receives and divides the output voltage (V_c) in known fashion in accordance with the relative size (resistance) of resistors R1 and R2. The midpoint of the voltage divider 610 is used to take an output voltage (V_{div}).

The CPU 50 receives the voltage V_{div} from the voltage divider and the reference voltage (V_r) from the voltage reference device 56. The CPU compares these two voltages and based on V_r is able to determine V_{div} . Furthermore, assuming that the (relative) resistances of R1 and R2 are known, the CPU is further able to determine the cell output

voltage (V_c) from V_{div} . This therefore allows the CPU to measure (track) the variation in voltage output (V_c) from the cell 54 as the cell discharges.

Figure 7 illustrates how in some embodiments of the disclosure, the power regulation system of the e-cigarette 10 uses a form of pulse-width modulation to compensate for the variation in voltage. Thus rather than the CPU 50 providing continuous electrical power to the heater in the vaporiser 40, the electrical power is supplied instead as a series of pulses at regular intervals, in effect, as a rectangular or square wave. Assuming that each pulse has an "on" duration of D_p , and a pulse is supplied every period of D_i (referred to as the pulse interval or interval duration), then the ratio of the pulse duration to the interval duration, D_p/D_i , is known as the duty cycle. If $D_p=D_i$ then the duty cycle is one (or 100%), and the CPU in effect provides a continuous voltage. However, if the duty cycle is less than 1, the CPU alternates periods of providing electrical power with periods of not providing electrical power. For example, if the duty cycle is 65%, then each voltage pulse has a duration representing 65% of the interval duration, and no voltage (or power) is supplied for the remaining 35% of the interval.

If we consider a signal level which provides power P for a duty cycle of 1 (i.e. continuous supply), then the average amount of power provided when the duty cycle is reduced below 1 is given by P multiplied by the duty cycle. Accordingly, if the duty cycle is 65% (for example), then the effective power rate becomes 65% of P .

Figure 7A illustrates two different rectangular waves, one shown in solid line, the other shown in dashed line. The pulse interval or period (D_i) is the same for both waves. The output shown in solid line has a pulse duration (width) of T_1 and a power output when on, i.e. an instantaneous power level, of P_1 . The duty cycle of this solid line output is T_1/D_i , to give an average power output of $P_1 \times T_1/D_i$. Likewise, the output shown in dashed line has a pulse duration (width) of T_2 and an instantaneous power output when on of P_2 . The duty cycle of this solid line output is T_2/D_i , to give an average power output of $P_2 \times T_2/D_i$.

Figure 7A also indicates in dotted line the average power output (P_{ave}), which is the same for both outputs (solid and dashed line). This implies that $(P_1 \times T_1/D_i) = (P_2 \times T_2/D_i)$. In other words, assuming that the pulse interval (D_i) is maintained constant, then the average power output is constant provided that the pulse duration (T) varies inversely with the (instantaneous) power output (P), so that $P \times T$ is also a constant.

In accordance with some embodiments of the disclosure, the power regulation system of the e-cigarette 10 implements a pulse-width modulation scheme such as shown in Figure 7A to provide the vaporiser heater with an approximately constant power level. Thus the power regulation system of Figure 6 allows the CPU 50 to track the current voltage output level from the cell 54. Based on this measured voltage output level, the CPU then sets an appropriate duty cycle for controlling power to the vaporiser heater to compensate

for variations in the voltage output level from the cell 54, thereby providing the vaporiser heater with an approximately constant (average) power level. Note that the pulse interval is chosen to be sufficiently short (typically $\ll 1$ second) such that it is much smaller than the thermal response time of the heater. In other words, the "off" portions of each pulse are
5 short enough that the heater does not cool significantly during this period. Therefore, the heater provides in effect a constant heat source for vaporising the nicotine, based on the average received power level, with no significant modulation in heat output at the timescale of individual pulse intervals.

Figure 7B illustrates in schematic form the mapping from the (measured) voltage
10 output level to duty cycle. When the cell 54 provides its lowest output voltage (3.6V), the duty cycle is set to 1 (the maximum possible value). When the cell 54 provides its highest output voltage (4.2V), the duty cycle is set to ~ 0.73 . Figure 7B also illustrates schematically the duty cycle for intervening voltages, such that the duty cycle (equivalent to pulse duration for a fixed pulse interval) varies inversely with power output (which is proportional to V^2 for a
15 fixed heater resistance). It will be appreciated that the precise variation of duty cycle with voltage shown in Figure 7B is by way of example only, and may vary according to the details of any given implementation.

As a consequence of the pulse-width modulation scheme described above, the CPU
50 is able to maintain the average power output supplied from cell 54 to the vaporiser heater
20 at an approximately constant level, despite variations in the output voltage level from cell 54. This helps to provide a more consistent heating effect, and hence a more consistent level of nicotine vaporisation and therefore inhalation for a user.

Although the e-cigarette described herein comprises three detachable sections, namely the body, cartridge and vaporiser, it will be appreciated that other e-cigarettes may
25 comprise a different number of sections. For example, some e-cigarettes are supplied as a single (unitary) complete device, and cannot be separated at all into different sections, while other e-cigarettes may comprise two sections, in effect, combining the vaporiser described herein with a liquid reservoir, forming a cartomiser. In addition, the e-cigarette described herein comprises multiple features, such as pulse-width modulation for providing a more
30 consistent power level, threshold setting for reliable monitoring of inhalation duration, monitoring cumulative inhalation and/or checking against successive inhalations of excessive length to help protect against abuse, and reverting to sleep mode after a period of inactivity to help protect the device. However, it will be appreciated that some electronic vapour provision system may only have some (or one) of these features, which may be
35 provided in any combination as desired.

In order to address various issues and advance the art, this disclosure shows by way of illustration various embodiments in which the claimed invention(s) may be practiced. The

advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and to teach the claimed invention(s). It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects of the disclosure are not to be considered limitations on the disclosure as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claims. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc other than those specifically described herein. The disclosure may include other inventions not presently claimed, but which may be claimed in future.

CLAIMS

1. An electronic vapour provision system including:
a pressure drop or air flow sensor for monitoring inhalation by a user through the
5 electronic vapour provision system; and
a control unit for detecting the start and end of inhalation based on readings from the
sensor;
wherein the control unit is configured to:
monitor the cumulative period of inhalation (T_i) over a predetermined window (T_w);
10 and
transfer the electronic vapour provision system to a sleep mode if the cumulative
period (T_i) exceeds a predetermined threshold (T_h).
2. An electronic vapour provision system according to claim 1, wherein the
15 predetermined window (T_w) is fixed in period.
3. An electronic vapour provision system according to claim 1, wherein the
predetermined window (T_w) represents a rolling window.
- 20 4. An electronic vapour provision system according to any preceding claim, wherein the
control unit is further configured to:
monitor the period of inhalation;
if the period of inhalation exceeds a first threshold:
render the electronic vapour provision system inactive for a predetermined
25 period;
render the electronic vapour provision system active after the predetermined
period has expired;
monitor the period of the next inhalation such that if the period of the next inhalation
exceeds a second threshold:
30 transfer the electronic vapour provision system to a sleep mode.
5. An electronic vapour provision system including:
a pressure drop or air flow sensor for monitoring inhalation by a user through the
electronic vapour provision system; and
35 a control unit for detecting the start and end of inhalation based on readings from the
sensor, wherein the control unit is configured to:
monitor the period of inhalation;

- if the period of inhalation exceeds a first threshold:
render the electronic vapour provision system inactive for a predetermined period;
render the electronic vapour provision system active after the predetermined period has expired;
5 monitor the period of the next inhalation such that if the period of the next inhalation exceeds a second threshold:
transfer the electronic vapour provision system to a sleep mode.
- 10 6. An electronic vapour provision system according to claim 4 or 5, wherein the first threshold is substantially the same in period as the second threshold.
7. An electronic vapour provision system according to any of claims 4 to 6, wherein the first threshold is from 3 to 5 seconds.
- 15 8. An electronic vapour provision system according to any one of claims 4 to 7, wherein the second threshold is from 3 to 5 seconds
9. An electronic vapour provision system according to any one of claims 4 to 8, wherein
20 the period of inactivity is from 3 to 5 seconds.
10. An electronic vapour provision system according to any preceding claim, wherein the control unit is further configured to:
detect the start of inhalation when the sensor reading departs by more than a first
25 threshold from a previous reading; and
detect the end of inhalation when the sensor reading departs by less than a second threshold from the previous reading;
wherein the first threshold is greater than the second threshold.
- 30 11. An electronic vapour provision system including:
a pressure drop or air flow sensor for monitoring inhalation by a user through the electronic vapour provision system; and
a control unit for detecting the start and end of inhalation based on readings from the sensor;
35 wherein the control unit is configured to:
detect the start of inhalation when the sensor reading departs by more than a first threshold from a previous reading; and

detect the end of inhalation when the sensor reading departs by less than a second threshold from the previous reading;

wherein the first threshold is greater than the second threshold.

- 5 12. The electronic vapour provision system of claim 10 or 11, wherein the previous reading comprises an ambient value which is updated on a periodic basis.
13. The electronic vapour provision system of any of claims 10 to 12, wherein upon
10 detection of the start of inhalation the control unit increases the rate at which a sensor reading is obtained.
14. The electronic vapour provision system of any one of claims 10 to 13, wherein upon
15 detection of the start of inhalation the control unit sets one or more timers to track the duration of this particular inhalation.
- 15 15. The electronic vapour provision system of any one of claims 10 to 14, wherein the first threshold may be an absolute or relative difference with respect to the previous reading.
16. The electronic vapour provision system of claim 15, wherein the first threshold is an
20 absolute difference with respect to the previous reading, for example a drop in pressure of (one of) 200, 300 or 400 Pascals.
17. The electronic vapour provision system of claim 15, wherein the first threshold is a
25 percentage difference with respect to the previous reading, for example a percentage drop of 0.2%, 0.3% or 0.4% compared with the previous reading.
18. The electronic vapour provision system of any one of claims 10 to 17, wherein the
30 second threshold may be an absolute or relative difference with respect to the previous reading.
19. The electronic vapour provision system of claim 18, wherein the second threshold is
an absolute difference with respect to the previous reading, for example a drop in pressure
of (one of) 80, 100 or 120 Pascals.
- 35 20. The electronic vapour provision system of claim 18, wherein the second threshold is a percentage difference with respect to the previous reading, for example a percentage drop of 0.08%, 0.1% or 0.12% compared with the previous reading.

21. An electronic vapour provision system according to any preceding claim, wherein upon entering sleep mode, one or more components of the system must be disengaged and re-engaged to transfer the system from the sleep mode to a user mode.

5

22. An electronic vapour provision system according to claim 21, the system comprising a vaporiser for vaporising liquid for inhalation by a user of the electronic vapour provision system and a power supply comprising a cell or battery for supplying power to the vaporiser, wherein following being transferred to sleep mode the system is transferred back to a user mode whereby power is available to the vaporiser said transfer occurring by disengaging and re-engaging the vaporiser from the power supply.

10

23. An electronic vapour provision system including:
a vaporiser for vaporising liquid for inhalation by a user of the electronic vapour provision system;
a power supply comprising a cell or battery for supplying power to the vaporiser; and
a power regulation system for compensating for variation in the voltage level of the power supplied to the vaporiser by the power supply using pulse-width modulation, thereby providing a more consistent output level of vaporised liquid for inhalation by the user.

15

20

24. The electronic vapour provision system of claim 23, wherein the power regulation system comprises a voltage reference generator, and the voltage level of the power supplied to the vaporiser is determined based on a comparison with the voltage from the voltage reference generator.

25

25. The electronic vapour provision system of claim 23 or 24, wherein the power regulation system comprises a voltage divider for dividing the voltage from the power supply prior to the comparison with the voltage from the voltage reference generator.

30

26. The electronic vapour provision system of claim 25, wherein voltage divider comprises a pair of resistors in series.

27. The electronic vapour provision system of claim 26, wherein the resistors are matched so that the ratio of the resistance of the two resistors is relatively stable with temperature.

35

28. The electronic vapour provision system of any one of claims 23 to 27, wherein the pulse-width modulation has a duty cycle of one when the cell or battery has its lowest operational output voltage level.
- 5 29. The electronic vapour provision system of any one of claims 23 to 28, wherein the power regulation system is able to provide an approximately constant power level to the vaporiser.
30. The electronic vapour provision system of any one of claims 1 to 22, further including
10 the features of the electronic vapour provision system of any one of claims 23 to 29.
31. An electronic vapour provision system including:
a vaporiser for vaporising liquid for inhalation by a user of the electronic vapour provision system;
15 a power supply comprising a cell or battery for supplying power to the vaporiser; and
a control unit for controlling the supply of power from the power supply to the vaporiser, the control unit having a sleep mode where no power is supplied to the vaporiser and a user mode where power is available for supply to the vaporiser, whereby the control unit reverts from user mode to sleep mode after a predetermined amount of time of inactivity
20 in user mode and/or after the vaporiser has been disengaged from the power supply.
32. An electronic vapour provision system according to claim 31, wherein the control unit reverts from user mode to sleep mode after a predetermined amount of time of inactivity in user mode, for example for greater than 4 minutes.
25
33. An electronic vapour provision system according to claim 31 or 32, wherein the control unit is transferred back to user mode by disengaging and re-engaging the vaporiser with the power supply.
- 30 34. An electronic vapour provision system according to any of claims 31 to 33, wherein the control unit reverts from user mode to sleep mode after the vaporiser has been disengaged from the power supply.
35. An electronic vapour provision system according to claim 34, wherein the control unit
35 is transferred back to user mode by re-engaging the vaporiser with the power supply.

36. The electronic vapour provision system of any one of claims 1 to 30, further including the features of the electronic vapour provision system of any one of claims 31 to 35.

37. An electronic vapour provision system as substantially defined herein.

5

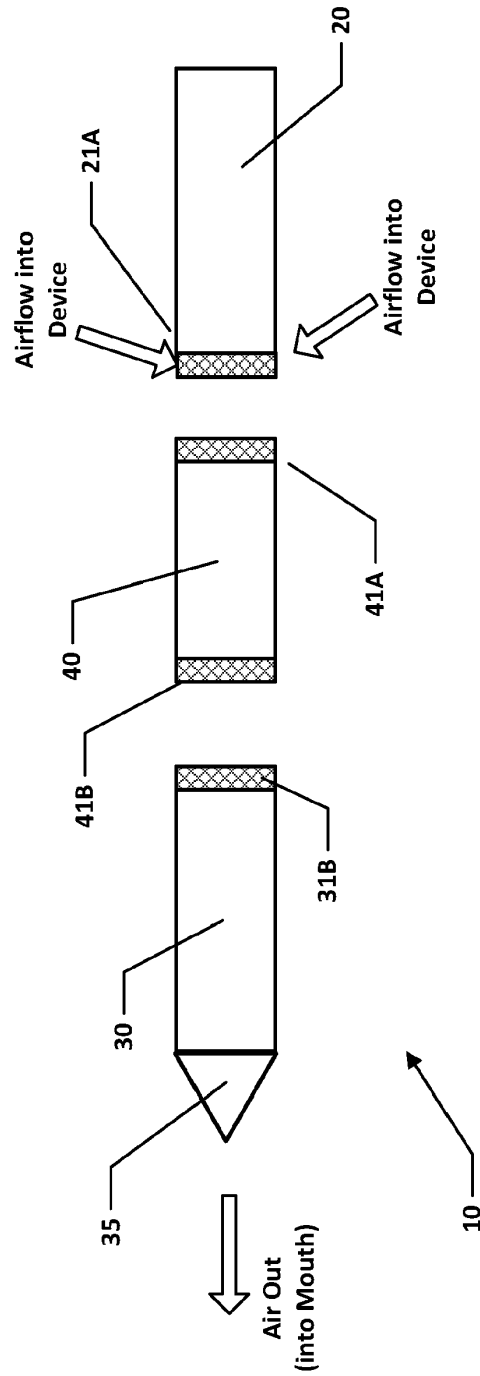


Figure 1

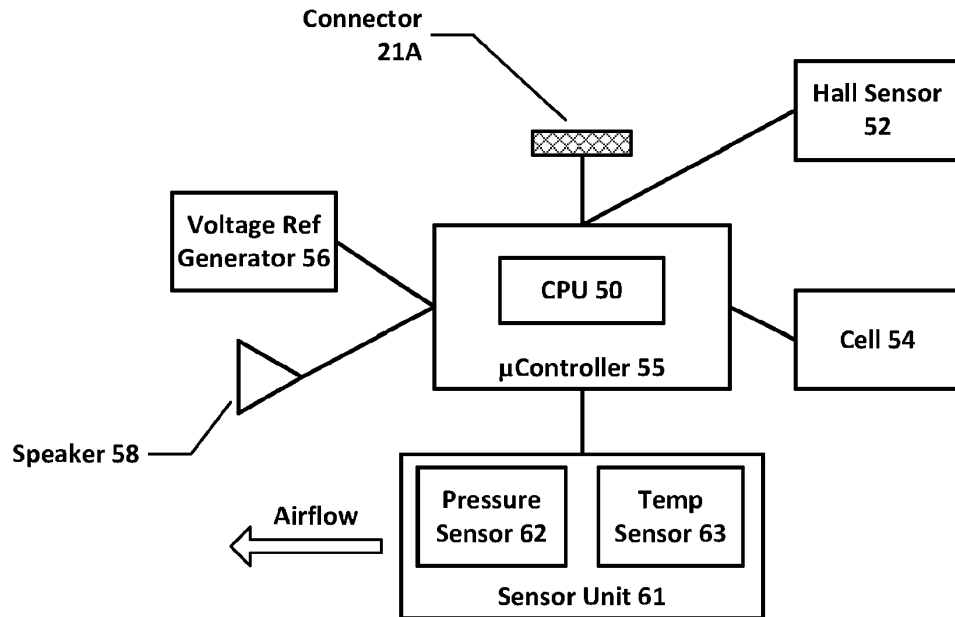


Figure 2

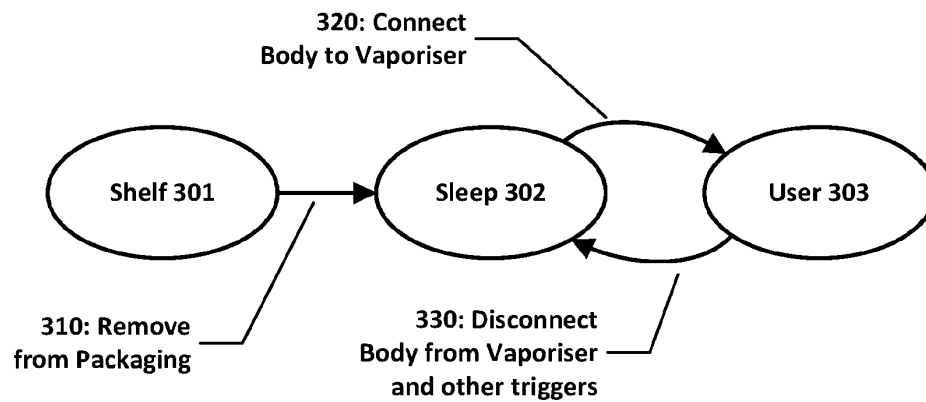


Figure 3

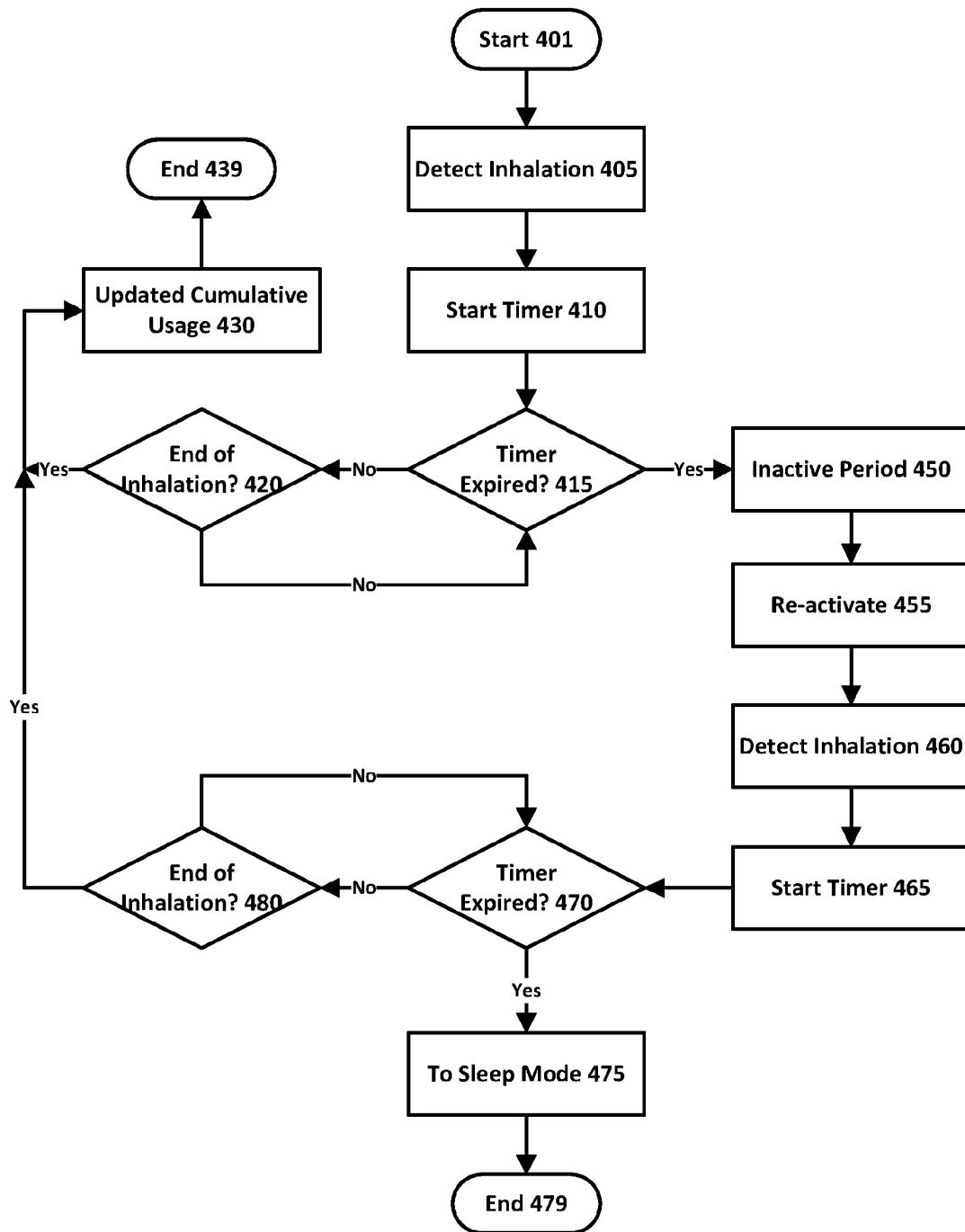


Figure 4

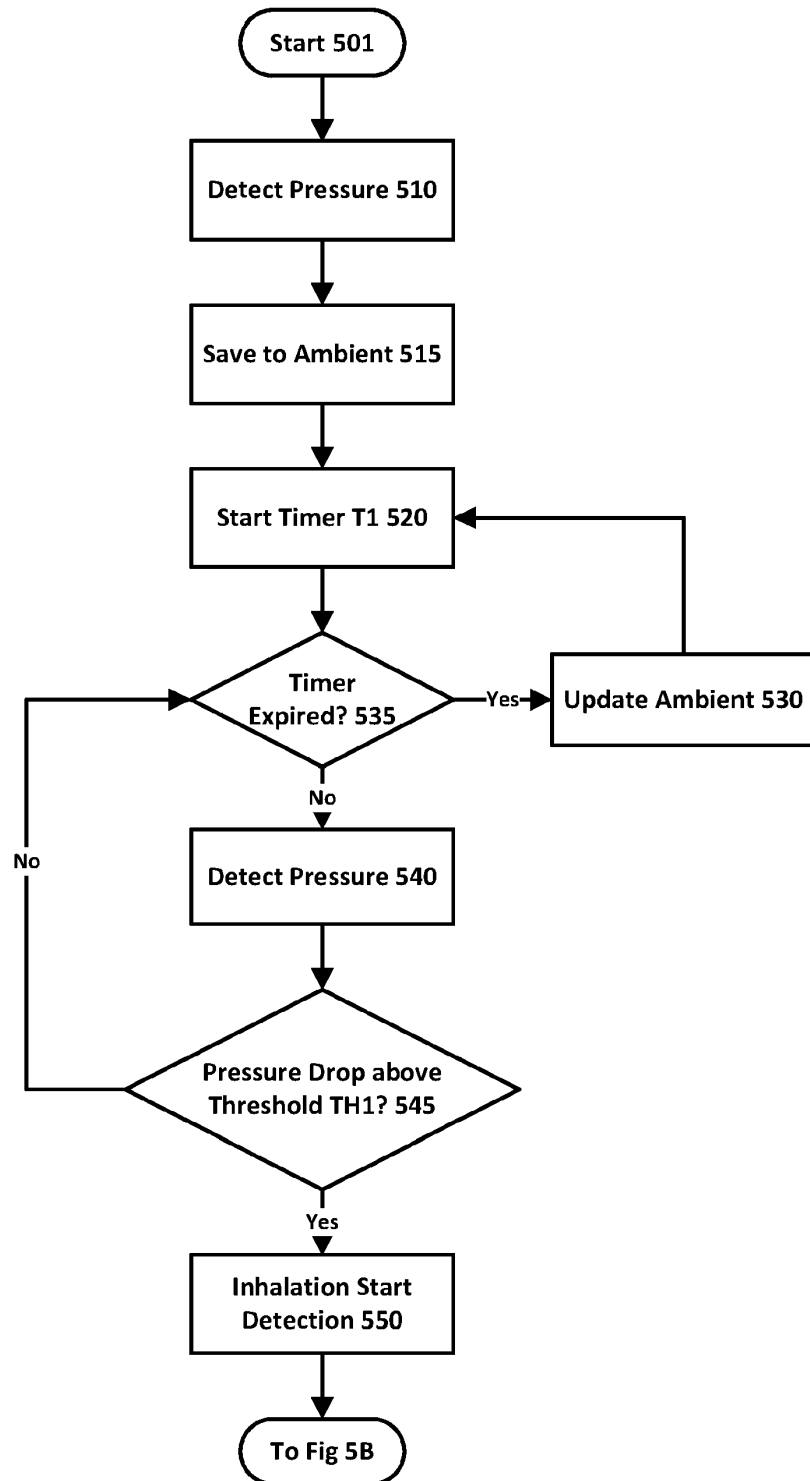


Figure 5A

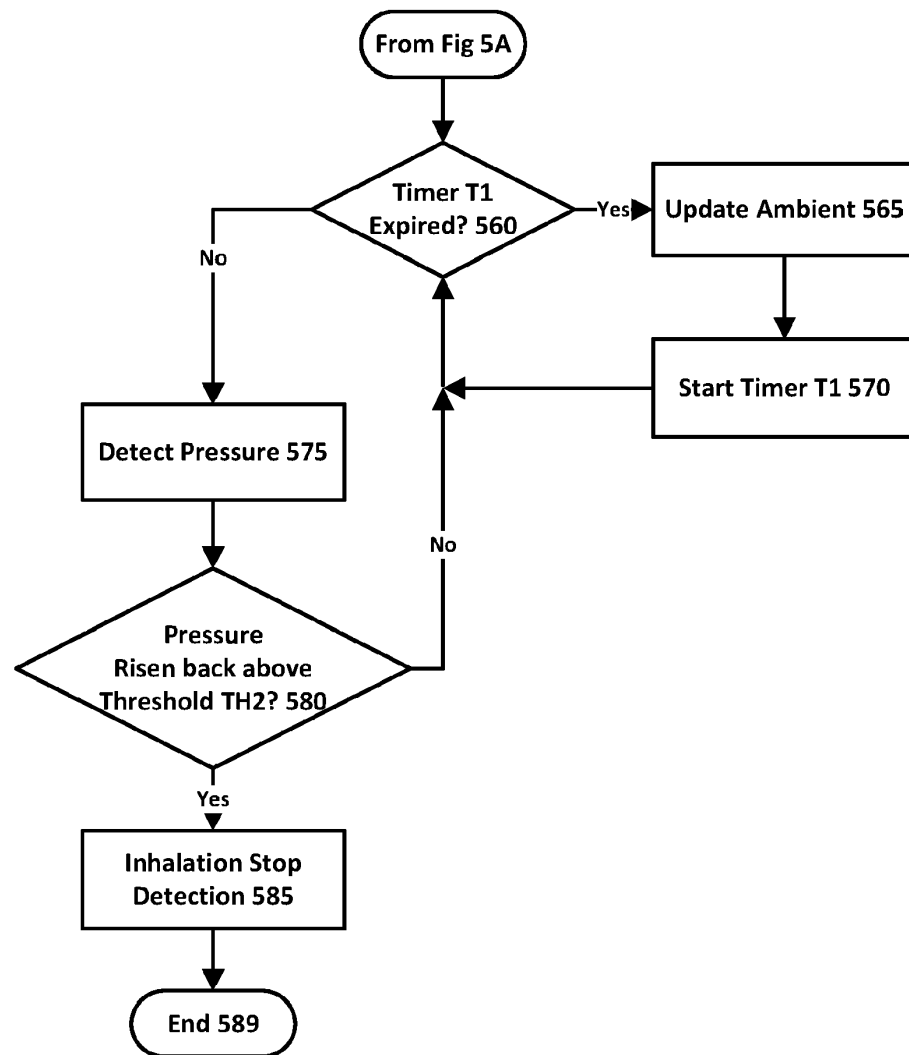


Figure 5B

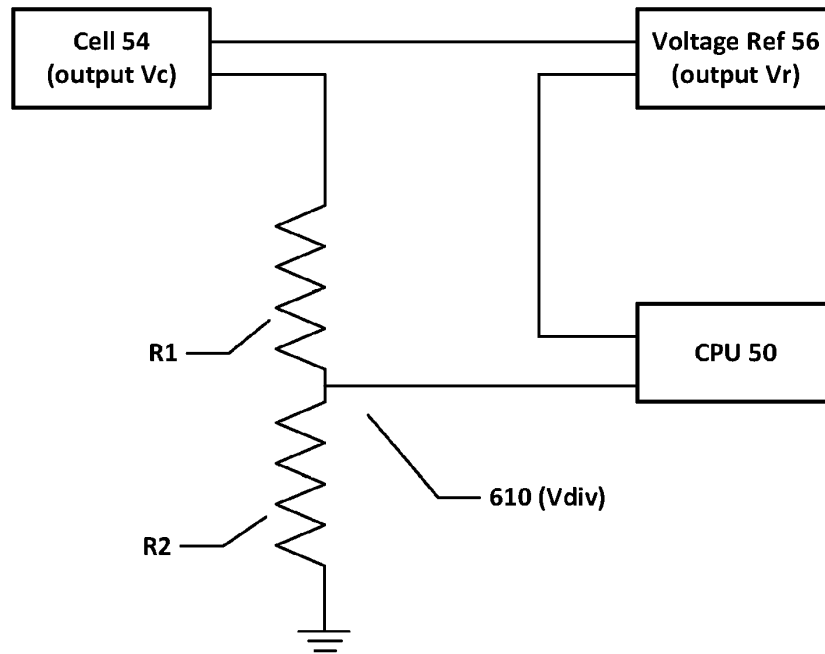


Figure 6

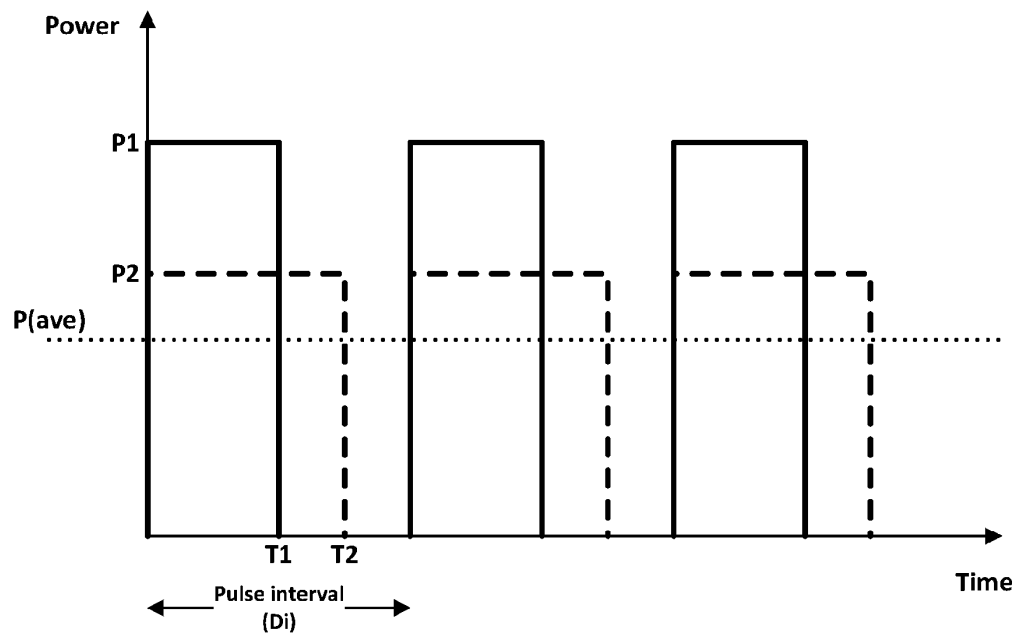


Figure 7A

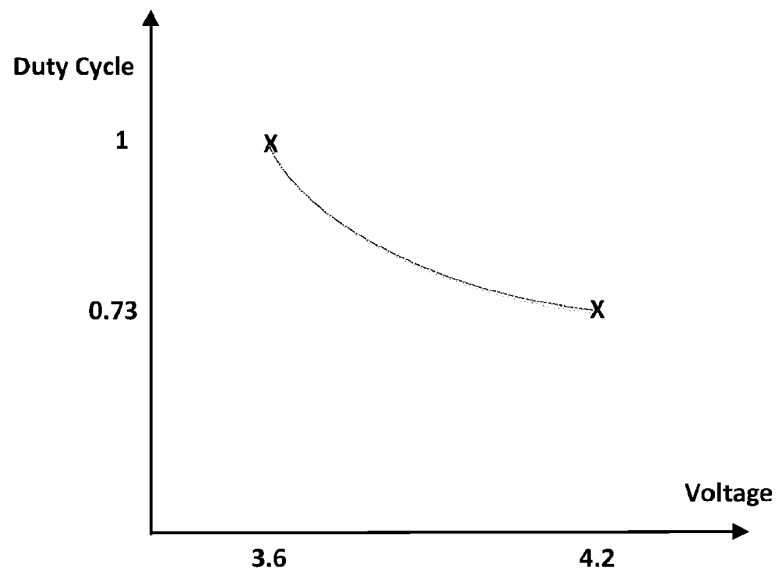


Figure 7B

Electronic Acknowledgement Receipt	
EFS ID:	36944390
Application Number:	16032009
International Application Number:	
Confirmation Number:	7691
Title of Invention:	VAPORIZER APPARATUS
First Named Inventor/Applicant Name:	James Monsees
Customer Number:	148514
Filer:	Nicholas Paul Mouton/Shae Jackson
Filer Authorized By:	Nicholas Paul Mouton
Attorney Docket Number:	52210-508C18US/716.US18
Receipt Date:	21-AUG-2019
Filing Date:	10-JUL-2018
Time Stamp:	22:44:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no				
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<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

SCORE Placeholder Sheet for IFW Content

Application Number: 16032009

Document Date: 11/22/2019

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- Drawing

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- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
James Monsees et al.

Allowed: May 21, 2019

Application No.: 16/032,009

Confirmation No.: 7691

Filed: July 10, 2018

Art Unit: 1747

For: VAPORIZER APPARATUS

Examiner: Michael J. Felton

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

FILED VIA EFS

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir or Madam:

In response to the Notice to File Corrected Application Papers mailed July 22, 2019 ("Notice"), please amend the above-identified application as follows.

Amendments to the Claims begin on page 2 of this paper.

Amendments to the Drawings begin on page 8 of this paper.

Amendments to the Specification begin on page 9 of this paper.

Remarks begin on page 10 of this paper.

Replacement Sheet 22 of 24

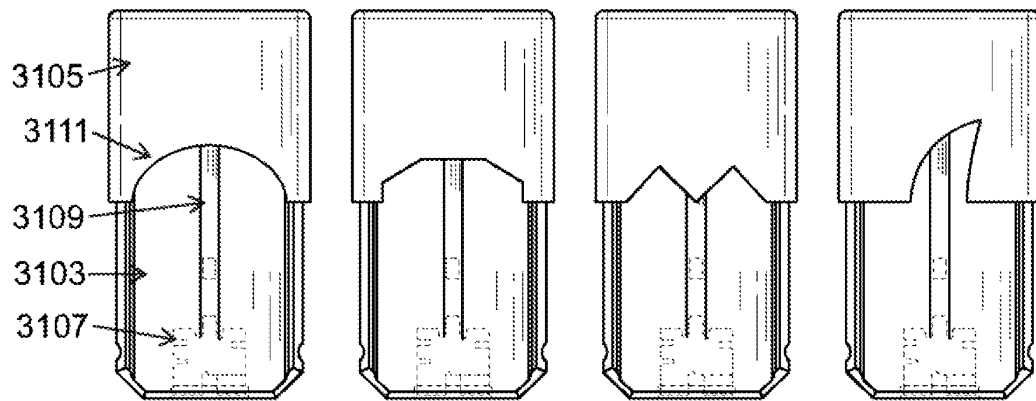


FIG. 31A

FIG. 31B

FIG. 31C

FIG. 31D

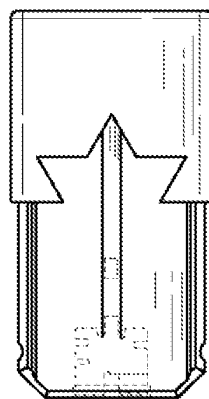


FIG. 31E

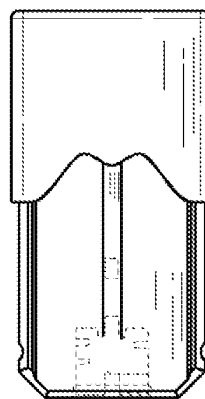


FIG. 31F

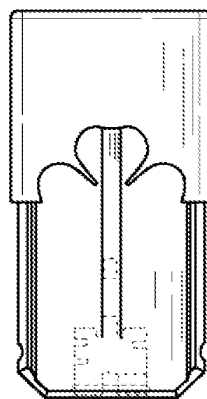


FIG. 31G

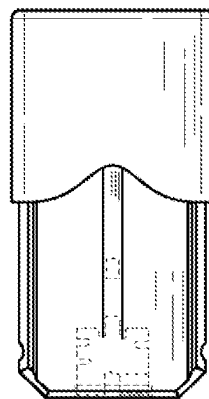


FIG. 31H

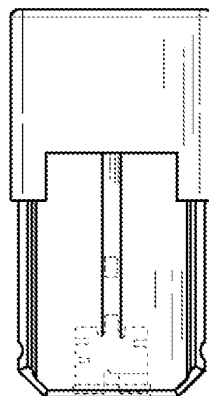


FIG. 31I

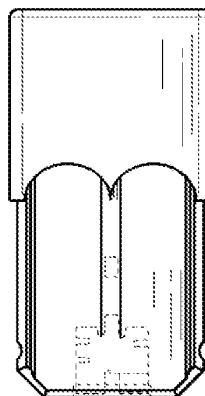


FIG. 31J

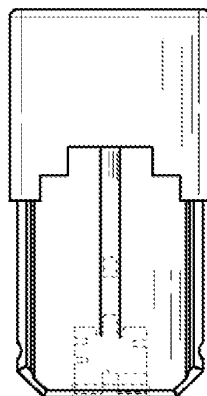


FIG. 31K

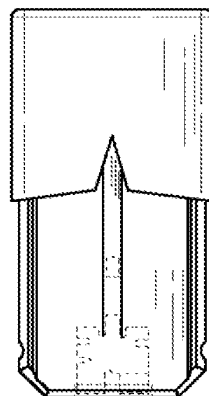


FIG. 31L

Electronic Patent Application Fee Transmittal				
Application Number:		16032009		
Filing Date:		10-Jul-2018		
Title of Invention:		VAPORIZER APPARATUS		
First Named Inventor/Applicant Name:		James Monsees		
Filer:		Justin James Leisey/Matthew Tupper		
Attorney Docket Number:		62210-508C18US/716.US18		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension - 2 months with \$0 paid	1252	1	600	600
Miscellaneous:				
Total in USD (\$)				600

Electronic Acknowledgement Receipt	
EFS ID:	37835048
Application Number:	16032009
International Application Number:	
Confirmation Number:	7691
Title of Invention:	VAPORIZER APPARATUS
First Named Inventor/Applicant Name:	James Monsees
Customer Number:	148514
Filer:	Justin James Leisey/Matthew Tupper
Filer Authorized By:	Justin James Leisey
Attorney Docket Number:	62210-508C18US/716.US18
Receipt Date:	22-NOV-2019
Filing Date:	10-JUL-2018
Time Stamp:	15:50:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 600
RAM confirmation Number	E2019ALF51140842
Deposit Account	500311
Authorized User	Matthew Tupper
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.19 (Document supply fees)</p> <p>37 CFR 1.21 (Miscellaneous fees and charges)</p>	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		062210-508C18US_Response.pdf	175205	yes	10
			99843c6290ee4d260346ec6de338d0cb51736403		
	Multipart Description/PDF files in .zip description				
	Document Description		Start		End
	Applicant Arguments/Remarks Made in an Amendment		10		10
	Specification		9		9
	Drawings-only black and white line drawings		8		8
	Claims		2		7
	Amendment after Notice of Allowance (Rule 312)		1		1
Warnings:					
Information:					
2	Drawings-other than black and white line drawings	062210-508C18US_ReplacementSheet.pdf	168951	no	1
			962906d22d8c31284fd6ec0216189ca49170fc9b		
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30513	no	2
			fa57e78c01c90c9c7ebca9668bc8d593f21abe8b		
Warnings:					
Information:					
Total Files Size (in bytes):			374669		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

REMARKS

By this response, the Drawings are amended to replace the label to FIG. 31H with a legible version. The Specification has been amended with replacement paragraph [0342] that corrects a typographical error. Also, the Claims have been amended to correct typographical error. Support for these amendments are present in at least the originally-filed application. Accordingly, no new matter has been added.

That any specific rejection, issue, or comment was not particularly addressed, does not signify agreement with that rejection, issue, or comment. In addition, because the arguments made by the Applicant are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper.

This paper is filed concurrently with fees for a two-month extension of time. However, the Commissioner is hereby authorized to charge any fees that may be due, or credit any overpayment of same, to Deposit Account No. 50-0311, Reference No. 52210-508C18US/716.US18. If there are any questions regarding this response, the Examiner is encouraged to contact the undersigned at the telephone number provided below.

Respectfully submitted,

Dated: November 22, 2019

/Justin J Leisey/

Justin J. Leisey

Registration No.: 65,082

MINTZ LEVIN COHN FERRIS GLOVSKY

AND POPEO, P.C.

3580 Carmel Mountain Road, Suite 300

San Diego, California 92130-6768

(858) 314-1500 || (858) 314-1501 (Fax)

Attorney for Applicant

IN THE SPECIFICATION:

Please replace paragraph [0342] on page 68 with the following paragraph. The amendment to this paragraph is indicated by strikethrough and underlining.

[0342] A mechanical coupling or connection between the cartridge 2801 and the vaporizer 2803 is visible in the enlarged view of FIG. 28D. In this example, the outer surface of the elongate and flattened storage compartment 2855 (which is not covered at the distal end by the mouthpiece) engages snugly within the walls of the cartridge receptacle 2851.~~The~~

AMENDMENTS TO THE DRAWINGS

Applicant submits herewith formal replacement sheet correcting the label to FIG. 31H. Please replace the pending twenty second drawings sheet (with FIGs. 31A-L) with the formal replacement drawing sheet submitted herewith.

AMENDMENTS TO THE CLAIMS

Please amend the claims as set forth below. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims:

1. – 20. (Canceled)

21. (Previously Presented) An apparatus comprising:

a cartridge comprising a mouthpiece, a storage compartment configured to hold a vaporizable material, and a heater chamber comprising a resistive heating element configured to heat the vaporizable material, wherein the heating of the vaporizable material generates an aerosol comprising the vaporizable material and air passing along an airflow path; and

a body comprising a receptacle configured to insertably receive and couple to the cartridge, wherein the heater chamber is disposed within the receptacle when the receptacle insertably receives and couples to the cartridge,

wherein the airflow path comprises:

an air inlet passage having a first side formed by an exterior surface of the cartridge and a second side formed by an internal surface of the receptacle when the receptacle insertably receives and couples to the cartridge, wherein the air inlet passage is configured to deliver the air to the heater chamber; and

a fluid connection in the cartridge, the fluid connection connecting the heater chamber and the mouthpiece.

22. (Previously Presented) The apparatus of claim 21, wherein the cartridge further comprises a protrusion extending from the exterior surface of the cartridge, and wherein at least part of the protrusion is disposed within the receptacle when the receptacle insertably receives and couples to the cartridge.

23. (Previously Presented) The apparatus of claim 21, wherein the cartridge has a proximal end and a distal end opposite the proximal end, wherein the mouthpiece is disposed at the proximal end, and wherein the heater chamber is disposed proximate to the distal end.

24. (Previously Presented) The apparatus of claim 23, wherein the receptacle terminates in a proximal edge, wherein the air inlet passage extends from the proximal edge of the receptacle towards the distal end of the cartridge when the receptacle insertably receives and couples to the cartridge.

25. (Previously Presented) The apparatus of claim 23, wherein the mouthpiece comprises a condensation chamber, wherein the mouthpiece further comprises a first aerosol outlet and a second aerosol outlet, and wherein each of the first aerosol outlet and the second aerosol outlet are in fluid communication with the condensation chamber.

26. (Previously Presented) The apparatus of claim 23, wherein the cartridge has a longitudinal dimension extending from the proximal end of the cartridge to the distal end of the cartridge, and wherein the exterior surface of the cartridge and the internal surface of the receptacle are substantially parallel to the longitudinal dimension when the receptacle insertably receives and couples to the cartridge.

27. (Previously Presented) The apparatus of claim 23, wherein the storage compartment comprises the exterior surface of the cartridge forming the first side of the air inlet passage.

28. (Previously Presented) The apparatus of claim 23, wherein the storage compartment comprises four exterior walls between the distal end and the proximal end, and wherein the mouthpiece comprises four interior walls between the distal end and the proximal end, and wherein the mouthpiece is attached over part of the storage compartment by a snap fit coupling.

29. (Previously Presented) The apparatus of claim 28, wherein the mouthpiece forms a cavity, wherein a first portion of the storage compartment is disposed inside of the cavity and a

second portion of the storage compartment is disposed outside of the cavity, at least part of the second portion configured for insertion into the receptacle.

30. (Previously Presented) The apparatus of claim 29, wherein a surface feature of the cavity is configured to secure the mouthpiece to the storage compartment.

31. (Previously Presented) The apparatus of claim 29, wherein the mouthpiece comprises a first coupling feature and a second coupling feature, wherein the storage compartment comprises a third coupling feature and a fourth coupling feature on opposite exterior surfaces of the storage compartment, wherein the first coupling feature is configured to couple with one of the third coupling feature and the fourth coupling feature, and wherein the second coupling feature is configured to couple with the other of the third coupling feature and the fourth coupling feature.

32. (Previously Presented) The apparatus of claim 31, wherein the third coupling feature comprises a first raised rail, and wherein the fourth coupling feature comprises a second raised rail.

33. (Previously Presented) The apparatus of claim 29, wherein the mouthpiece is opaque, and wherein the second portion of the storage compartment comprises a surface configured so that the vaporizable material is visible through the surface.

34. (Previously Presented) The apparatus of claim 33, wherein the receptacle is configured so that the second portion of the storage compartment is visible when the cartridge is coupled to the receptacle, through a notch in the receptacle.

35. (Previously Presented) The apparatus of claim 21, wherein the cartridge comprises a first electrical contact and a second electrical contact at a distal end of the cartridge, the mouthpiece disposed at a proximal end of the cartridge opposite the distal end, wherein the first electrical contact and the second electrical contact are electrically isolated and disposed in a plane substantially parallel to the distal end of the cartridge.

36. (Previously Presented) The apparatus of claim 35, wherein the receptacle comprises a third electrical contact and a fourth electrical contact disposed in a second plane, the

second plane substantially parallel to the distal end of the cartridge when the cartridge is received within the receptacle.

37. (Previously Presented) The apparatus of claim 21, wherein a wick comprises at least one of: a silica material, a cotton material, a ceramic material, a hemp material, and a stainless steel material.

38. (Previously Presented) The apparatus of claim 21, wherein the body has a top end and a bottom end opposite the top end, wherein the receptacle is disposed at the top end, wherein a body longitudinal axis extends from the top end to the bottom end, and wherein a first body transverse axis and a second body transverse axis extend substantially perpendicular to the body longitudinal axis, the body having a greater dimension along the first body transverse axis than along the second body transverse axis.

39. (Previously Presented) The apparatus of claim 21, wherein the storage compartment comprises the vaporizable material, and wherein the vaporizable material comprises a nicotine formulation.

40. (Previously Presented) An apparatus comprising:

a cartridge comprising a mouthpiece, a storage compartment configured to hold a vaporizable material, and a resistive heating element configured to heat the vaporizable material, wherein the heating of the vaporizable material generates an aerosol comprising the vaporizable material and air passing along an airflow path; and

a body comprising a receptacle configured to insertably receive and couple to the cartridge, wherein the resistive heating element is disposed within the receptacle when the receptacle insertably receives and couples to the cartridge,

wherein the airflow path comprises:

an air inlet passage having a first side formed by an exterior surface of the cartridge and a second side formed by an internal surface of the receptacle when the receptacle insertably receives and couples to the cartridge, wherein the air inlet passage is configured to deliver the air towards the resistive heating element; and

a fluid connection in the cartridge, the fluid connection connecting the resistive heating element and the mouthpiece.

41. (Previously Presented) The apparatus of claim 40, wherein the cartridge further comprises a protrusion extending from the exterior surface of the cartridge, and wherein at least part of the protrusion is disposed within the receptacle when the receptacle insertably receives and couples to the cartridge.

42. (Previously Presented) The apparatus of claim 40, wherein the cartridge has a proximal end and a distal end opposite the proximal end, wherein the mouthpiece is disposed at the proximal end, and wherein the resistive heating element is disposed proximate to the distal end.

43. (Previously Presented) The apparatus of claim 42, wherein the receptacle terminates in a proximal edge, wherein the air inlet passage extends from the proximal edge of the receptacle towards the distal end of the cartridge when the receptacle insertably receives and couples to the cartridge.

44. (Previously Presented) The apparatus of claim 42, wherein the cartridge has a longitudinal dimension extending from the proximal end of the cartridge to the distal end of the cartridge, and wherein the exterior surface of the cartridge and the internal surface of the receptacle are substantially parallel to the longitudinal dimension when the receptacle insertably receives and couples to the cartridge.

45. (Previously Presented) The apparatus of claim 42, wherein the storage compartment comprises the exterior surface of the cartridge forming the first side of the air inlet passage.

46. (Previously Presented) The apparatus of claim 42, wherein the storage compartment comprises four exterior walls between the distal end and the proximal end, and wherein the mouthpiece comprises four interior walls between the distal end and the proximal end,

and wherein the mouthpiece is attached over part of the storage compartment by a snap fit coupling.

47. (Previously Presented) The apparatus of claim 46, wherein the mouthpiece forms a cavity, wherein a first portion of the storage compartment is disposed inside of the cavity and a second portion of the storage compartment is disposed outside of the cavity, at least part of the second portion configured for insertion into the receptacle.

48. (Previously Presented) The apparatus of claim 40, wherein the body has a top end and a bottom end opposite the top end, wherein the receptacle is disposed at the top end, wherein a body longitudinal axis extends from the top end to the bottom end, and wherein a first body transverse axis and a second body transverse axis extend substantially perpendicular to the body longitudinal axis, the body having a greater dimension along the first body transverse axis than along the second body transverse axis.

49. (Previously Presented) The apparatus of claim 21, wherein the receptacle comprises an opening that is between approximately 13 to approximately 14 mm long, approximately 4.5 to approximately 5.5 mm wide, and at least 10 mm deep.

50. (**Currently Amended**) The apparatus of claim [[21]] 40, wherein the storage compartment comprises the vaporizable material, and wherein the vaporizable material comprises a nicotine formulation.



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NOTICE OF ALLOWANCE AND FEE(S) DUE

148514 7590 12/16/2019
Mintz/JUUL
One Financial Center
Boston, MA 02111

EXAMINER

FELTON, MICHAEL J

ART UNIT

PAPER NUMBER

1747

DATE MAILED: 12/16/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691

TITLE OF INVENTION: VAPORIZER APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	03/16/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

148514 7590 12/16/2019
Mintz/JUUL
One Financial Center
Boston, MA 02111

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691

TITLE OF INVENTION: VAPORIZER APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1000	\$0.00	\$0.00	\$1000	03/16/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
FELTON, MICHAEL J	1747	131-329000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	12/16/2019	EXAMINER	
Mintz/JUUL			FELTON, MICHAEL J	
One Financial Center			ART UNIT	
Boston, MA 02111			PAPER NUMBER	
			1747	
DATE MAILED: 12/16/2019				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b) (2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/032,009	Applicant(s) Monsees et al.	
	Examiner MICHAEL J FELTON	Art Unit 1747	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the Request for Continued Examination received 11/22/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 21-50. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☐ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/Michael J Felton/ Primary Examiner, Art Unit 1747	
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<i>Search Notes</i> 	Application/Control No. 16/032,009	Applicant(s)/Patent Under Reexamination Monsees et al.
	Examiner MICHAEL J FELTON	Art Unit 1747

CPC - Searched*		
Symbol	Date	Examiner

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
See EAST search history	10/01/2018	MJF
See EAST search history	05/13/2019	MJF
See EAST search history	12/09/2019	MJF

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	See EAST search history	05/13/2019	MJF
	updated search	12/09/2019	MJF

/Michael J Felton/ Primary Examiner, Art Unit 1747	
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Issue Classification 	Application/Control No. 16/032,009	Applicant(s)/Patent Under Reexamination Monsees et al.	
	Examiner MICHAEL J FELTON	Art Unit 1747	

CPC						
Symbol					Type	Version
A24F	/	47	/	008	F	2013-01-01
H05B	/	3	/	44	I	2013-01-01
A61M	/	11	/	042	I	2014-02-04
A61M	/	15	/	06	I	2013-01-01
H05B	/	1	/	0244	I	2013-01-01
H05B	/	1	/	0227	I	2013-01-01
H05B	/	2203	/	022	A	2013-01-01
A61M	/	2205	/	3653	A	2013-01-01
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CPC Combination Sets					
Symbol	Type	Set	Ranking	Version	
/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/Michael J Felton/ Primary Examiner, Art Unit 1747	09 December 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	21	10A

Issue Classification 	Application/Control No. 16/032,009	Applicant(s)/Patent Under Reexamination Monsees et al.
	Examiner MICHAEL J FELTON	Art Unit 1747

INTERNATIONAL CLASSIFICATION			
CLAIMED			
A24F47/00		47	00
NON-CLAIMED			

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE (Assistant Examiner)		Total Claims Allowed: 30	
/Michael J Felton/ Primary Examiner, Art Unit 1747 (Primary Examiner)		09 December 2019 (Date)	O.G. Print Claim(s) 21
			O.G. Print Figure 10A

Issue Classification 	Application/Control No. 16/032,009	Applicant(s)/Patent Under Reexamination Monsees et al.
	Examiner MICHAEL J FELTON	Art Unit 1747

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 30	
/Michael J Felton/ Primary Examiner, Art Unit 1747 (Primary Examiner) _____ (Date) _____		09 December 2019 O.G. Print Claim(s) 21	O.G. Print Figure 10A

U.S. Patent and Trademark Office

Part of Paper No.: 20191209

Docket No.: 62210-508C18US/716.US18
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
James Monsees et al.

Allowed: May 21, 2019

Application No.: 16/032,009

Confirmation No.: 7691

Filed: July 10, 2018

Art Unit: 1747

For: VAPORIZER APPARATUS

Examiner: Michael J. Felton

INFORMATION DISCLOSURE STATEMENT (IDS)

FILED VIA EFS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Pursuant to 37 C.F.R. §§ 1.56, 1.97, and 1.98, the attention of the United States Patent and Trademark Office is hereby directed to the references listed on the attached PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of the above-identified application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

This Information Disclosure Statement, pursuant to 37 C.F.R. § 1.114(c), accompanies the Request for Continued Examination (37 C.F.R. § 1.114) submitted herewith.

In accordance with 37 C.F.R. § 1.98(a)(2)(ii), copies of U.S. patents and U.S. patent application publications are not submitted. Submitted herewith are copies of foreign patents and non-patent literature in accordance with 37 C.F.R. § 1.98(a)(2).

In accordance with 37 CFR § 1.56(a)(1), Applicant hereby provides the Office with the following chart of references¹ cited in USPTO Office Actions and search reports of a foreign patent office in related applications:

¹ In accordance with M.P.E.P § 609.04(a), analogous US patent application publications are provided herein in place of non-US patent application publications, where applicable.

Application No.: 16/032,009

Docket No.: 62210-508C18US/716.US18

Document Number/Information	Publication Date (MM-DD-YYYY)	Name of Patentee, Applicant, or Author
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Docket No.: 62210-508C18US/716.US18

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In accordance with 37 CFR § 1.56 and MPEP 2001.06(c), Applicant hereby provides the Office with the following chart of references² cited in litigation involving related applications, including U.S. International Trade Commission Investigation No. 337-TA-1139³, U.S. International Trade Commission Investigation No. 337-TA-1141⁴, and U.S. District Court Case No. 2:19-cv-08405-JMV-MF:

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² In accordance with M.P.E.P. § 609.04(a), analogous US patent application publications are provided herein in place of non-US patent application publications, where applicable.

³ Applicant notes that there are a number of pending district court cases that are related to this ITC action, which are stayed by statute subject to the outcome of the ITC action.

⁴ Applicant notes that there are a number of pending district court cases that are related to this ITC action, which are stayed by statute subject to the outcome of the ITC action.

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In accordance with 37 CFR § 1.56 and MPEP 2001.06(c), Applicant also hereby provides the Office with the following chart of products⁵ cited in litigation involving related applications, including U.S. International Trade Commission Investigation No. 337-TA-1139, U.S. International Trade Commission Investigation No. 337-TA-1141, and U.S. District Court Case No. 2:19-cv-08405-JMV-MF:

⁵ Applicant notes that all information about the products, outside of the product names listed in the chart, has been designated as confidential business information by third parties under protective orders in the noted ITC investigations, and is not available to Applicant.

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Product Name
3 M Drug Delivery Systems inhaler
Panasonic KX-T4400 Cordless Phone and Answering Machine, Operating Manual, and Service Manual (1994)
Go.Pen Plus Vaporizer
Cloud Phantom Device
Cloud F17 Device
Cloud Classic Liquid Device
Cloud Classic Liquid Vaporizer
Cloud Slim Device
Cloud Vape Pen
Cloud Electro Device
Cloud Electro Mini Device
Cloud Alien Device
Cloud Classic Device
O.penVape Craft Reserve cartrdiges
O.penVape Reserve Cartridges
O.penVape cartrdiges
O.penVape ISH
O.penVape Micro ISH, Micro Reserve, and Micro Craft Reserve
O.penVape O.ne Device
O.penVape Go.pen Device
O.penVape Batteries (Original Battery, 2.0 Battery, Dual Logic Battery, and ISH Battery)
Bakked Dabaratus
Bakked Cartrdiges
Bakked Jars

In accordance with 37 CFR § 1.56(a)(2) and MPEP 2004⁶, Applicant hereby provides the Office with the following chart of references which the Applicant believes may also include relevant information over which the pending claims patentably defines:

⁶ See Note 10: "When in doubt, it is desirable and safest to submit information." *But see also* Note 13: "It is desirable to avoid the submission of long lists of documents if it can be avoided... If a long list is submitted, highlight those documents which have been specifically brought to applicant's attention and/or are known to be of most significance."

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Document Number/Information	Publication Date (MM-DD-YYYY)	Name of Patentee, Applicant, or Author
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In accordance with 37 C.F.R. § 1.97(g), the filing of this Information Disclosure Statement shall not be construed as a representation that a search has been made. In accordance with 37 C.F.R. § 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that the information cited in this Information Disclosure Statement is, or is considered to be, material to the patentability as defined in 37 C.F.R. § 1.56(b).

It is submitted that the Information Disclosure Statement is in compliance with 37 C.F.R. § 1.98, and the Examiner is respectfully requested to consider the listed references. Further, in accordance with MPEP 609.02, it is requested that the examiner consider information which has been considered by the Office in the parent applications of this continuation application, including U.S. Patent App. No. 15/257,760 and U.S. Patent App. No. 14/581,666.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 50-0311, under Order No. 62210-508C18US/716.US18 from which the undersigned is authorized to draw.

Dated: August 21, 2019

Respectfully submitted,

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Michael D. Van Loy
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12/09/2019

Bibliographic Data

Application No: 16/032,009

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged:

/Michael J Felton/

Examiner's Signature

Initials

Title:

VAPORIZER APPARATUS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
07/10/2018	131	1747	62210-508C18US/716.US18
RULE			

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CONTINUING DATA

This application is a CON of 15257760 09/06/2016 PAT 10076139

15257760 is a CIP of 35001169 07/28/2016 PAT D825102

15257760 is a CIP of 35001170 07/28/2016 PAT D842536

15257760 has PRO of 62294285 02/11/2016

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15257760 is a CIP of 14581666 12/23/2014 PAT 10058124

14581666 has PRO of 61937755 02/10/2014

14581666 has PRO of 61936593 02/06/2014

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

07/25/2018

STATE OR COUNTRY

UNITED STATES

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Boston, MA 02111
UNITED STATES

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\$5,860

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(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	1	of	20	Attorney Docket Number	62210-508C18US/716.US18

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MJF/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	2	of	20	Attorney Docket Number	62210-508C18US/716.US18

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	BN	US-20130037041-A1	02-14-2013	Worm et al.	
	BO	US-20130042865-A1	02-21-2013	MONSEES et al.	
	BP	US-20130081642-A1	04-04-2013	Safari	
	BQ	US-20130099725-A1	04-25-2013	Burrell et al.	
	BR	US-20130168880-A1	07-04-2013	DUKE	
	BS	US-20130182421-A1	07-18-2013	Popper et al.	
	BT	US-20130192615-A1	08-01-2013	Tucker et al.	
	BU	US-20130192619-A1	08-01-2013	Tucker et al.	
	BV	US-20130213419-A1	08-22-2013	Tucker et al.	
	BW	US-20130220314-A1	08-29-2013	Bottom	
	BX	US-20130220315-A1	08-29-2013	Conley et al.	
	BY	US-20130220316-A1	08-29-2013	Oglesby et al.	
	BZ	US-20130228191-A1	09-05-2013	Newton	
	CA	US-20130253433-A1	09-26-2013	Senior et al.	
	CB	US-20130255702-A1	10-03-2013	Griffith, JR. et al.	
	CC	US-20130306065-A1	11-21-2013	Thorens et al.	
	CD	US-20130306084-A1	11-21-2013	Flick	
	CE	US-20130319435-A1	12-05-2013	Flick	
	CF	US-20130323941-A1	12-05-2013	Zeliff et al.	
	CG	US-20130333711-A1	12-19-2013	Liu	
	CH	US-2014/0150783-A1	06-05-2014	Liu	
	CI	US-20140007891-A1	01-09-2014	Liu	
	CJ	US-20140014124-A1	01-16-2014	Glasberg et al.	

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	CK	US-20140014126-A1	01-16-2014	Peleg et al.	
	CL	US-20140053856-A1	02-27-2014	Liu	
	CM	US-20140053857-A1	02-27-2014	Liu	
	CN	US-20140053858-A1	02-27-2014	Liu	
	CO	US-20140107815-A1	04-17-2014	LaMothe	
	CP	US-20140116455-A1	05-01-2014	Youn	
	CQ	US-20140123990-A1	05-08-2014	Timmermans	
	CR	US-20140144429-A1	05-29-2014	Wensley et al.	
	CS	US-20140144453-A1	05-29-2014	Capuano et al.	
	CT	US-20140150784-A1	06-05-2014	Liu	
	CU	US-20140161301-A1	06-12-2014	MERENDA	
	CV	US-20140174458-A1	06-26-2014	KATZ	
	CW	US-20140178461-A1	06-26-2014	RIGAS	
	CX	US-20140182610-A1	07-03-2014	Liu	
	CY	US-20140190496-A1	07-10-2014	Wensley et al.	
	CZ	US-20140202454-A1	07-24-2014	Buchberger	
	DA	US-20140224244-A1	08-14-2014	Liu	
	DB	US-20140253144-A1	09-11-2014	Novak, III et al.	
	DC	US-20140261408-A1	09-18-2014	DePiano et al.	
	DD	US-20140261486-A1	09-18-2014	Potter et al.	
	DE	US-20140261490-A1	09-18-2014	Kane	
	DF	US-20140261493-A1	09-18-2014	Smith et al.	
	DG	US-20140261495-A1	09-18-2014	Novak, III et al.	
	DH	US-20140270727-A1	09-18-2014	Ampolini et al.	
	DI	US-20140270729-A1	09-18-2014	DePiano et al.	
	DJ	US-20140270730-A1	09-18-2014	DePiano et al.	
	DK	US-20140276536-A1	09-18-2014	Estes	
	DL	US-20140283858-A1	09-25-2014	Liu	
	DM	US-20140299137-A1	10-09-2014	Kieckbusch et al.	
	DN	US-20140299141-A1	10-09-2014	FLICK	
	DO	US-20140305454-A1	10-16-2014	Rinker et al.	
	DP	US-20140332020-A1	11-13-2014	Li et al.	
	DQ	US-20140332022-A1	11-13-2014	Li et al.	
	DR	US-20140338685-A1	11-20-2014	Amir	
	DS	US-20140345631-A1	11-27-2014	Bowen et al.	
	DT	US-20140345633-A1	11-27-2014	Talon et al.	
	DU	US-20140355969-A1	12-04-2014	Stern	
	DV	US-20140366898-A1	12-18-2014	MONSEES et al.	
	DW	US-20140373857-A1	12-25-2014	Steinberg	
	DX	US-20140376895-A1	12-25-2014	Han	
	DY	US-2015/0118895-A1	04-30-2015	Zheng et al.	
	DZ	US-20150013696-A1	01-15-2015	Plojoux et al.	
	EA	US-20150020831-A1	01-22-2015	Weigensberg et al.	
	EB	US-20150027457-A1	01-29-2015	Janardhan et al.	
	EC	US-20150027460-A1	01-29-2015	Liu	
	ED	US-20150027471-A1	01-29-2015	Feldman et al.	

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	EE	US-20150034104-A1	02-05-2015	Zhou	
	EF	US-20150034507-A1	02-05-2015	Liu	
	EG	US-20150059783-A1	03-05-2015	Liu	
	EH	US-20150059787-A1	03-05-2015	Qiu	
	EI	US-20150070832-A1	03-12-2015	Schneider et al.	
	EJ	US-20150083147-A1	03-26-2015	Schiff et al.	
	EK	US-20150090256-A1	04-02-2015	CHUNG	
	EL	US-20150090281-A1	04-02-2015	Chen	
	EM	US-20150101606-A1	04-16-2015	White	
	EN	US-20150101625-A1	04-16-2015	Newton et al.	
	EO	US-20150101626-A1	04-16-2015	Li et al.	
	EP	US-20150128971-A1	05-14-2015	Verleur et al.	
	EQ	US-20150128972-A1	05-14-2015	Verleur et al.	
	ER	US-20150128976-A1	05-14-2015	Verleur et al.	
	ES	US-20150136158-A1	05-21-2015	Stevens et al.	
	ET	US-20150157055-A1	06-11-2015	Lord	
	EU	US-20150164147-A1	06-18-2015	Verleur et al.	
	EV	US-20150173124-A1	06-18-2015	Qiu	
	EW	US-20150181940-A1	07-02-2015	Liu	
	EX	US-20150181944-A1	07-02-2015	Li et al.	
	EY	US-20150189919-A1	07-09-2015	Liu	
	EZ	US-20150196060-A1	07-16-2015	Wensley et al.	
	FA	US-20150208728-A1	07-30-2015	Lord	
	FB	US-20150208729	07-2015	Monsees et al.	
	FC	US-20150216237-A1	08-06-2015	Wensley et al.	
	FD	US-20150217068-A1	08-06-2015	Wakalopoulos	
	FE	US-20150223521-A1	08-13-2015	Menting et al.	
	FF	US-20150237916-A1	08-27-2015	Farine et al.	
	FG	US-20150245654-A1	09-03-2015	MEMARI et al.	
	FH	US-20150245655-A1	09-03-2015	MEMARI et al.	
	FI	US-20150245657-A1	09-03-2015	MEMARI et al.	
	FJ	US-20150245665-A1	09-03-2015	MEMARI et al.	
	FK	US-20150245666-A1	09-03-2015	MEMARI et al.	
	FL	US-20150245667-A1	09-03-2015	MEMARI et al.	
	FM	US-20150245668-A1	09-03-2015	MEMARI et al.	
	FN	US-20150245669-A1	09-03-2015	CADIEUX et al.	
	FO	US-20150257447-A1	09-17-2015	Sullivan	
	FP	US-20150282526-A1	10-08-2015	Wu	
	FQ	US-20150289565-A1	10-15-2015	CADIEUX et al.	
	FR	US-20150296889-A1	10-22-2015	LIU	
	FS	US-20150305409-A1	10-29-2015	Verleur et al.	
	FT	US-20150313283-A1	11-05-2015	Collett et al.	
	FU	US-20150313287-A1	11-05-2015	VERLEUR et al.	
	FV	US-20150320116-A1	11-12-2015	Bleloch et al.	
	FW	US-20150327595-A1	11-19-2015	Scatterday	
	FX	US-20150335071-A1	11-26-2015	Brinkley et al.	

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	FY	US-20150351455-A1	12-10-2015	LIU	
	FZ	US-20150357608-A1	12-10-2015	Huang	
	GA	US-20150359263-A1	12-17-2015	BELLINGER	
	GB	US-2016/0353804-A1	12-08-2016	LORD	
	GC	US-20160007651-A1	01-14-2016	Ampolini et al.	
	GD	US-20160021933-A1	01-28-2016	THORENS et al.	
	GE	US-20160044962-A1	02-18-2016	THORENS et al.	
	GF	US-20160095356-A1	04-07-2016	Chan	
	GG	US-20160106153-A1	04-21-2016	Zhu	
	GH	US-20160150824-A1	06-02-2016	MEMARI et al.	
	GI	US-20160157523-A1	06-09-2016	LIU	
	GJ	US-20160198768-A1	07-14-2016	Liu	
	GK	US-20160270442-A1	09-22-2016	Liu	
	GL	US-20160278436-A1	09-29-2016	Verleur et al.	
	GM	US-20160331032-A1	11-17-2016	MALGAT et al.	
	GN	US-20160360790-A1	12-15-2016	Calfee et al.	
	GO	US-20160374393-A1	12-29-2016	CHEN	
	GP	US-2017/0197046-A1	07-13-2017	BUCHBERGER	
	GQ	US-20170035115-A1	02-09-2017	MONSEES et al.	
	GR	US-20170095005-A1	04-06-2017	MONSEES et al.	
	GS	US-20170119044-A1	05-04-2017	OLIGSCHLAEGER et al.	
	GT	US-20170156404-A1	06-08-2017	Novak, III et al.	
	GU	US-20170157341-A1	06-08-2017	PANDYA et al.	
	GV	US-20170231276-A1	08-17-2017	MIRONOV et al.	
	GW	US-20170318861-A1	11-09-2017	THORENS	
	GX	US-20170367410-A1	12-28-2017	HON	
	GY	US-20180070644-A1	03-15-2018	Monsees et al.	
	GZ	US-20180177234-A1	06-28-2018	LEE	
	HA	US-20190037926-A1	02-07-2019	QIU	
	HB	US-3,085,145	04-09-1963	Wray	
	HC	US-3,271,719	09-06-1966	Ovshinsky	
	HD	US-3,918,451	11-11-1975	Steil	
	HE	US-3,934,117	01-20-1976	Schladitz	
	HF	US-4,171,000	10-16-1979	Uhle	
	HG	US-4,492,480	01-08-1985	Wadso et al.	
	HH	US-4,548,454	10-22-1985	Zeller et al.	
	HI	US-4,745,705	05-24-1988	Yamamoto et al.	
	HJ	US-4,793,365	12-27-1988	Sensabaugh, Jr. et al.	
	HK	US-4,811,731	03-14-1989	Newell et al.	
	HL	US-4,947,874	08-14-1990	Brooks et al.	
	HM	US-4,947,875	08-14-1990	Brooks et al.	
	HN	US-4,993,436	02-19-1991	Bloom, Jr.	
	HO	US-5,042,509	08-27-1991	Banerjee et al.	
	HP	US-5,117,482	05-26-1992	Hauber	
	HQ	US-5,144,962	09-08-1992	Counts et al.	
	HR	US-5,259,786	11-09-1993	Huang	

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	HS	US-5,261,424	11-16-1993	Sprinkel, Jr.	
	HT	US-5,269,327	12-14-1993	Counts et al.	
	HU	US-5,479,948	01-02-1996	Counts et al.	
	HV	US-5,661,329	08-26-1997	Hiramoto et al.	
	HW	US-5,682,050	10-28-1997	Williams	
	HX	US-5,865,185	02-02-1999	Collins et al.	
	HY	US-6,090,082	07-18-2000	King et al.	
	HZ	US-6,155,268	12-05-2000	Takeuchi	
	IA	US-6,203,339	03-20-2001	Nieminen	
	IB	US-6,283,610	09-04-2001	Alajajian	
	IC	US-6,516,796	02-11-2003	Cox et al.	
	ID	US-6,637,430	10-28-2003	Voges et al.	
	IE	US-6,708,846	03-23-2004	Fuchs et al.	
	IF	US-6,743,030	06-01-2004	Lin et al.	
	IG	US-6,772,756	08-10-2004	Shayan	
	IH	US-7,019,491	03-28-2006	Bozzzone et al.	
	II	US-7,173,222	02-06-2007	Cox et al.	
	IJ	US-7,214,075	05-08-2007	He et al.	
	IK	US-7,275,941	10-02-2007	Bushby	
	IL	US-7,318,435	01-15-2008	Pentafragas	
	IM	US-7,646,613	01-12-2010	Ligtenberg et al.	
	IN	US-7,726,320	06-01-2010	Robinson et al.	
	IO	US-7,802,569	09-28-2010	Yeates et al.	
	IP	US-7,905,236	03-15-2011	Bryman et al.	
	IQ	US-7,913,688	03-29-2011	Cross et al.	
	IR	US-8,485,180	07-16-2013	Smutney et al.	
	IS	US-8,522,776	09-03-2013	Wright et al.	
	IT	US-8,528,569	09-10-2013	Newton	
	IU	US-8,752,545-B2	06-17-2014	Buchberger	
	IV	US-8,833,364	09-16-2014	Buchberger	
	IW	US-8,881,738	11-11-2014	Bryman	
	IX	US-8,893,726-B2	11-25-2014	Hon	
	IY	US-8,897,628	11-25-2014	Conley et al.	
	IZ	US-8,991,402	03-31-2015	Bowen et al.	
	JA	US-9,010,335	04-21-2015	Scatterday	
	JB	US-9,072,321	07-07-2015	Liu	
	JC	US-9,078,473	07-14-2015	Worm et al.	
	JD	US-9,101,729-B2	08-11-2015	Liu	
	JE	US-9,132,248	09-15-2015	Qiu	
	JF	US-9,167,849	10-27-2015	Adamic	
	JG	US-9,220,302	12-29-2015	DePiano et al.	
	JH	US-9,247,773	02-02-2016	Memari et al.	
	JI	US-9,271,529	03-01-2016	Alima	
	JJ	US-9,282,772	03-15-2016	Tucker et al.	
	JK	US-9,289,014	03-22-2016	Tucker et al.	
	JL	US-9,345,541	05-24-2016	Greeley et al.	

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	JM	US-9,386,805	07-12-2016	Liu	
	JN	US-9,408,416	08-09-2016	Monsees et al.	
	JO	US-9,414,629	08-16-2016	Egoyants et al.	
	JP	US-9,420,829	08-23-2016	Thorens et al.	
	JQ	US-9,423,152	08-23-2016	Ampolini et al.	
	JR	US-9,427,022	08-30-2016	Levin et al.	
	JS	US-9,498,588	11-22-2016	Benassayag et al.	
	JT	US-9,504,279	11-29-2016	Chen	
	JU	US-9,510,623	12-06-2016	Tucker et al.	
	JV	US-9,516,899	12-13-2016	Plojoux et al.	
	JW	US-9,526,273	12-27-2016	Liu	
	JX	US-9,549,573	01-24-2017	Monsees et al.	
	JY	US-9,609,893	04-04-2017	Novak, III et al.	
	JZ	US-9,675,109	06-13-2017	Monsees et al.	
	KA	US-9,714,878	07-25-2017	Powers et al.	
	KB	US-9,723,877	08-08-2017	Wong et al.	
	KC	US-9,772,245	09-26-2017	Besling et al.	
	KD	US-9,781,953	10-10-2017	Verleur et al.	
	KE	US-9,795,168	10-24-2017	Zhu	
	KF	US-9,801,413	10-31-2017	Zhu	
	KG	US-9,814,263	11-14-2017	Cochand et al.	
	KH	US-9,814,265	11-14-2017	Rinker et al.	
	KI	US-9,844,234	12-19-2017	Thorens et al.	
	KJ	US-9,861,135	01-09-2018	Chen	
	KK	US-9,974,743	05-22-2018	Rose et al.	
	KL	US-D143295	12-25-1945	Fisher	
	KM	US-D260690	09-08-1981	Stutzer	
	KN	US-D267590	01-11-1983	Varma	
	KO	US-D280494	09-10-1985	Abel	
	KP	US-D299066	12-20-1988	Newell et al.	
	KQ	US-D303722	09-26-1989	Marlow et al.	
	KR	US-D310349	09-04-1990	Rowen	
	KS	US-D336346	06-08-1993	Miller et al.	
	KT	US-D368552	04-02-1996	Adams	
	KU	US-D371633	07-09-1996	Chenard	
	KV	US-D379810	06-10-1997	Giordano, Jr. et al.	
	KW	US-D382146	08-12-1997	Sandy	
	KX	US-D397504	08-25-1998	Zelenik	
	KY	US-D398150	09-15-1998	Vonarburg	
	KZ	US-D405007	02-02-1999	Naas, Sr.	
	LA	US-D405413	02-09-1999	Segers	
	LB	US-D411332	06-22-1999	Zelenik	
	LC	US-D412279	07-27-1999	Brice	
	LD	US-D422884	04-18-2000	Lafond	
	LE	US-D424236	05-02-2000	Reed	
	LF	US-D433532	11-07-2000	Higgins et al.	

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	LG	US-D450313	11-13-2001	Koinuma	
	LH	US-D450662	11-20-2001	Kwok	
	LI	US-D478569	08-19-2003	Hussaini et al.	
	LJ	US-D478897	08-26-2003	Tsuge	
	LK	US-D500301	12-28-2004	Deguchi	
	LL	US-D500302	12-28-2004	Deguchi	
	LM	US-D505922	06-07-2005	Mayo et al.	
	LN	US-D506447	06-21-2005	Mayo et al.	
	LO	US-D506731	06-28-2005	Mayo et al.	
	LP	US-D507244	07-12-2005	Mayo et al.	
	LQ	US-D523171	06-13-2006	Mitten et al.	
	LR	US-D525948	08-01-2006	Blair et al.	
	LS	US-D528992	09-26-2006	Hobart et al.	
	LT	US-D529044	09-26-2006	Andre et al.	
	LU	US-D530340	10-17-2006	Andre et al.	
	LV	US-D531190	10-31-2006	Lee et al.	
	LW	US-D532927	11-28-2006	Sann	
	LX	US-D534921	01-09-2007	Andre et al.	
	LY	US-D535261	01-16-2007	Daniels	
	LZ	US-D535308	01-16-2007	Andre et al.	
	MA	US-D539813	04-03-2007	Chen	
	MB	US-D540749	04-17-2007	Kaule	
	MC	US-D545303	06-26-2007	Chang	
	MD	US-D545490	06-26-2007	Tai	
	ME	US-D545904	07-03-2007	Chen et al.	
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	CA	EP-2614731-A1	07-17-2013	Shenzhen First Union Technology Co., Ltd		
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	CU	WO-2013068100-A1	05-16-2013	Philip Morris Prod		
	CV	WO-2013083631-A1	06-13-2013	Philip Morris Prod		
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	CZ	WO-2013093695-A1	06-27-2013	Sis Resources Ltd		
	DA	WO-2013098397-A2	07-04-2013	Philip Morris Prod		
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	DR	WO-2015054862-A1	04-23-2015	Kimree Hi Tech Inc		
	DS	WO-2015077645-A1	05-28-2015	Corr-tech Associates, Inc		
	DT	WO-2015078147-A1	06-04-2015	Hk Triangle Co., Limited		
	DU	WO-2015082560-A1	06-11-2015	Philip Morris Products SA		
	DV	WO-2015114325-A1	08-06-2015	Batmark Ltd		
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	DX	WO-2016059000-A1	04-21-2016	Fontem Holdings 2 Bv		
	DY	WO-2017173951-A1	10-12-2017	Changzhou Jwei Intelligent Tech Co Ltd		
	DZ	WO-D79112-0010	12-21-2012	Philip Morris Products		
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Examiner Signature		Date Considered	
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				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	17	of	20	Attorney Docket Number	62210-508C18US/716.US18

NON PATENT LITERATURE DOCUMENTS				
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²	
	A	"2011 New Eigarette GS-360,With 1.2ml Clearomizer(Id:5861467) Product Details - View 2011 New Eigarette GS-360,With 1.2ml Clearomizer from Green Sound High-Tech Co.,Ltd - EC21." EC21, Global B2B Marketplace - Connecting Global Buyers with Manufacturers, Suppliers, Exporters Worldwide, (2011), wo1138.en.ec21.com/2011_New_Eigarette_GS-360_With--5366965_5861467.html.		
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	C	"Esteam and J-Series Owner's Manual." Allbrands.com, 2002, www.allbrands.com/misc_files/pdfs/JiffySteamerOwnersManual.pdf .		
	D	"Hacking the Vuse Eig to Fully Use Cartridges and Allow Refills." Hacking the Vuse Eig to Fully Use Cartridges and Allow Refills, 16 Oct. 2015, se.azinstall.net/2015/10/hacking-vuse-eig-puffounter.html?m=1".		
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				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	18	of	20	Attorney Docket Number	62210-508C18US/716.US18

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Sheet	19	of	20	Attorney Docket Number	62210-508C18US/716.US18

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Examiner Signature	/Michael J Felton/	Date Considered	12/09/2019
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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S2	41	((("BOWEN") near3 ("Adam"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:05
S3	3	((("HATTON") near3 ("Nicholas"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:06
S4	67	((("CHRISTENSEN") near3 ("Steven"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:06
S5	6	((("LOMELI") near3 ("Kevin"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:06
S6	5	((("ATKINS") near3 ("Ariel"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:06
S7	4	((("KELLER") near3 ("Aaron"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/20 12:06
S8	58	S1 S2 S3 S4 S5 S6 S7	USPAT	OR	OFF	2017/01/20 12:07
S9	111	S1 S2 S3 S4 S5 S6 S7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:07
S10	13	S9 and vaporizer and cartridge	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:09
S11	11	S9 and vaporizer and cartridge and magnetic	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:11
S12	2	S9 and vaporizer and cartridge and magnetic and cutout	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:11

S13	5	S9 and vaporizer and cartridge and magnetic and window	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:11
S14	34	S9 and channel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:24
S15	6	S9 and channel and transparent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:24
S16	9	S9 and transparent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 12:24
S17	8590	A24F47/008.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 13:51
S18	271	S17 and transparent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 13:52
S19	343	S17 and (transparent or window)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/20 13:52
S20	1403	A24F47/008.cpc. and (cartridge or cartomizer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/22 14:51
S21	1	15/257768.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	OFF	2017/01/22 15:33

			DERWENT; IBM_TDB			
S22	0	A24F47/008.cpc. and magenetic same (coupling or connector)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/22 16:13
S23	120	A24F47/008.cpc. and magnetic same (coupling or connector)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/22 16:13
S24	8	cigarette same rectangle same cross- section	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:30
S25	1568	rectangular near10 cigarette	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:30
S26	347	rectangular near2 cigarette	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:30
S27	36	square adj cigarette	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:32
S28	6639	A24F47/008	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:34
S29	221	A24F47/008 and rectangular	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:34
S30	13	(US-20150208729-\$ or US- 20070283972-\$ or US-20090095287-\$ or US-20130192623-\$ or US-	US-PGPUB; USPAT; FPRS;	OR	OFF	2017/01/23 10:42

		20130228191-\$ or US-20080257367-\$ or US-20100031968-\$).did. or (US-5649554-\$ or US-5819756-\$ or US-6155268-\$).did. or (GB-201222205-\$ or WO-2013044537-\$).did. or (WO-2007012007-\$).did.	DERWENT			
S31	1	S30 and pogo	US-PGPUB; USPAT; FPRS; DERWENT	OR	OFF	2017/01/23 10:42
S32	12	A24F47/008 and pogo	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 10:42
S33	10	(electronic adj cigarette) and pogo	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 11:04
S34	6639	A24F47/008	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/23 11:18
S35	42693	((liquid adj reservoir)	US-PGPUB; USPAT; FPRS; DERWENT	OR	OFF	2017/01/24 09:31
S36	417	((liquid adj reservoir) or (liquid near3 tank)) same (cover or case) same window	US-PGPUB; USPAT; FPRS; DERWENT	OR	OFF	2017/01/24 09:32
S37	28	((("MONSEES") near3 ("James")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S38	42	((("BOWEN") near3 ("Adam")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S39	4	((("HATTON") near3 ("Nicholas")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S40	68	((("CHRISTENSEN") near3 ("Steven")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S41	7	((("LOMELI") near3 ("Kevin")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S42	6	((("ATKINS") near3 ("Ariel")).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2017/01/26 11:25
S43	4	((("KELLER") near3 ("Aaron")).INV.	US-PGPUB; USPAT;	OR	OFF	2017/01/26 11:25

			USOCR			
S44	112	S37 S38 S39 S40 S41 S42 S43	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:25
S45	6	S44 and vaporizer and cartridge and window	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:25
S46	2	S44 and vaporizer and cartridge and transparent	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:27
S47	0	S44 and vaporizer and cartridge and clear	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:27
S48	12	S44 and vaporizer and cartridge and see	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:27
S49	490	A24F47/008.cpc. and (cartridge or cartomizer) and (transparent or visible or clear or window)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:29
S50	257	A24F47/008.cpc. and (cartridge or cartomizer) and (transparent or clear or window)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:29
S51	515	A24F47/008.cpc. and (transparent or clear or window)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/01/26 11:30
S52	221	cigarette and (window or transparent) same (tipping or plug or mouthpiece)	USPAT	OR	OFF	2017/02/19 12:28
S54	1	15/257748.app.	US-PGPUB;	OR	OFF	2017/02/24

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			11:22
S55	0	"20140261408".pn.	USPAT	OR	OFF	2017/09/07 13:53
S56	2	"20140261408".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/07 13:53
S57	2	"20150335071".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/07 14:04
S58	1	14/196729.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/08 10:47
S60	196	(US-1067531-\$ US-1163183-\$ US- 1299162-\$ US-1505748-\$ US- 1552877-\$ US-1632335-\$ US- 1706244-\$ US-1845340-\$ US- 1972118-\$ US-1998683-\$ US- 2031363-\$ US-2039559-\$ US- 2104266-\$ US-2159698-\$ US- 2177636-\$ US-2195260-\$ US- 2231909-\$ US-2327120-\$ US- 2460427-\$ US-2483304-\$ US- 2502561-\$ US-2765949-\$ US- 2830597-\$ US-2860638-\$ US- 2897958-\$ US-2935987-\$ US- 3146937-\$ US-3258015-\$ US- 3271719-\$ US-3292634-\$ US- 3373915-\$ US-3420360-\$ US- 3443827-\$ US-3456645-\$ US- 3479561-\$ US-3567014-\$ US- 3675661-\$ US-3707017-\$ US- 3792704-\$ US-3815597-\$ US- 3861523-\$ US-3941300-\$ US- 4020853-\$ US-4049005-\$ US- 4066088-\$ US-4207976-\$ US- 4215708-\$ US-4219032-\$ US- 4303083-\$ US-4506683-\$ US- 4519319-\$ US-4520938-\$ US- 4595024-\$ US-4625737-\$ US- 4648393-\$ US-4708151-\$ US- 4735217-\$ US-4771796-\$ US- 4793365-\$ US-4794323-\$ US- 4798310-\$ US-4813536-\$ US- 4819665-\$ US-4830028-\$ US- 4836224-\$ US-4846199-\$ US-	USPAT	OR	OFF	2017/09/13 12:31

4848374-\$	US-4848563-\$	US-
4870748-\$	US-4893639-\$	US-
4896683-\$	US-4907606-\$	US-
4924883-\$	US-4938236-\$	US-
4941483-\$	US-4944317-\$	US-
4945929-\$	US-4947874-\$	US-
4947875-\$	US-4955397-\$	US-
4984588-\$	US-5005759-\$	US-
5019122-\$	US-5020548-\$	US-
5027836-\$	US-5031646-\$	US-
5040551-\$	US-5050621-\$	US-
5060671-\$	US-5065776-\$	US-
5076297-\$	US-5101838-\$	US-
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6708846-\$	US-6726006-\$	US-
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6799576-\$	US-6803545-\$	US-

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S61	196	(US-6827573-\$ US-6854470-\$ US- 6874507-\$ US-6909840-\$ US- 6954979-\$ US-6994096-\$ US- 7000775-\$ US-7015796-\$ US- 7025066-\$ US-7082825-\$ US- 7117707-\$ US-7185659-\$ US- 7234593-\$ US-7290549-\$ US- 7374048-\$ US-7415982-\$ US- 7428905-\$ US-7434584-\$ US- 7488171-\$ US-7530352-\$ US- 7546703-\$ US-7581540-\$ US- 7621403-\$ US-7644823-\$ US- 7753055-\$ US-7767698-\$ US- 7793860-\$ US-7793861-\$ US- 7801573-\$ US-7813832-\$ US- 7815332-\$ US-7832397-\$ US- 7832410-\$ US-7886507-\$ US- 7913686-\$ US-7988034-\$ US- 8003080-\$ US-8042550-\$ US- 8079371-\$ US-8091558-\$ US- 8141701-\$ US-8156944-\$ US- 8157918-\$ US-8205622-\$ US- 8251060-\$ US-8282995-\$ US- 8308624-\$ US-8314235-\$ US- 8322350-\$ US-8371310-\$ US- 8375957-\$ US-8381739-\$ US- 8387612-\$ US-8393331-\$ US- 8402978-\$ US-8424539-\$ US- 8443534-\$ US-8464867-\$ US- 8479747-\$ US-8490629-\$ US- 8495998-\$ US-8499766-\$ US- 8511318-\$ US-8539959-\$ US- 8541401-\$ US-8550069-\$ US- 8578942-\$ US-8578943-\$ US- 8596460-\$ US-8646462-\$ US- 8671952-\$ US-8678012-\$ US- 8689789-\$ US-8689805-\$ US- 8695794-\$ US-8714150-\$ US- 8714161-\$ US-8733345-\$ US- 8733346-\$ US-8739788-\$ US- 8741348-\$ US-8752545-\$ US- 8752557-\$ US-8757169-\$ US- 8770187-\$ US-8781307-\$ US- 8790556-\$ US-8794231-\$ US- 8794244-\$ US-8794245-\$ US- 8807140-\$ US-8809261-\$ US- 8813747-\$ US-8813759-\$ US- 8820330-\$ US-8829395-\$ US- 8851068-\$ US-8851081-\$ US- 8851083-\$ US-8857446-\$ US- 8863752-\$ US-8869792-\$ US- 8881737-\$ US-8893726-\$ US- 8897628-\$ US-8899238-\$ US- 8899240-\$ US-8905040-\$ US- 8910630-\$ US-8910639-\$ US- 8910640-\$ US-8910641-\$ US- 8910783-\$ US-8915254-\$ US- 8919561-\$ US-8925555-\$ US- 8928277-\$ US-8931492-\$ US- 8950395-\$ US-8955522-\$ US- 8960199-\$ US-8967382-\$ US- 8973587-\$ US-8975764-\$ US- 8978663-\$ US-8991402-\$ US-	USPAT	OR	OFF	2017/09/13 12:32

		9010335-\$ US-9016274-\$ US- 9018899-\$ US-9022026-\$ US- 9022039-\$ US-9025291-\$ US- 9028808-\$ US-9032968-\$ US- 9038626-\$ US-9038642-\$ US- 9050431-\$ US-9055617-\$ US- 9055770-\$ US-9060388-\$ US- 9060548-\$ US-9066543-\$ US- 9072321-\$ US-9072322-\$ US- 9078472-\$ US-9078474-\$ US- 9078475-\$ US-9089166-\$ US- 9089168-\$ US-9095174-\$ US- 9095175-\$ US-9099873-\$ US- 9101729-\$ US-9113659-\$ US- 9131733-\$ US-9197726-\$ US- 9215895-\$ US-9220302-\$ US- 9226526-\$ US-9255277-\$ US- 9271525-\$ US-9271529-\$ US- 9272103-\$ US-9277769-\$ US- 9282772-\$ US-9282773-\$ US- 9289014-\$ US-9295286-\$ US- 9308336-\$ US-9320300-\$ US- 9326547-\$ US-9326549-\$ US- 9351522-\$ US-9364027-\$ US- 9364800-\$ US-9380810-\$ US- 9408416-\$ US-9439455-\$ US- 9462832-\$ US-9497998-\$ US- 9504279-\$ US-9532604-\$ US- 9532605-\$ US-9549572-\$ US- 9549573-\$ US-9572373-\$ US- 9602646-\$ US-9603387-\$ US- 9603389-\$ US-9609893-\$ US- 9648905-\$ US-9648909-\$ US- 9655890-\$ US-9668520-\$ US- 9675118-\$ US-9681687-\$).DID.				
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WO-2013044537-\$ | WO-2013076750-\$
| WO-2013083635-\$ | WO-
2013089551-\$ | WO-2013110208-\$ |
WO-2013110209-\$ | WO-2013110210-\$
| WO-2013113173-\$ | WO-
2013113174-\$ | WO-2013113612-\$ |
WO-2013116983-\$ | WO-2013131763-\$
| WO-2013142678-\$ | WO-
2013150406-\$ | WO-2013156658-\$ |
WO-2013171206-\$ | WO-2013174001-\$
| WO-2014020539-\$ | WO-
2014020953-\$ | WO-2014023171-\$ |
WO-2014032280-\$ | WO-2014040915-\$
| WO-2014047948-\$ | WO-
2014047955-\$ | WO-2014067236-\$ |
WO-2014071747-\$ | WO-2014101119-\$
| WO-2014101401-\$ | WO-

		2014101734-\$ WO-2014106323-\$ WO-2014110761-\$ WO-2014113949-\$ WO-2014121509-\$ WO- 2014125340-\$ WO-2014127446-\$ WO-2014134781-\$ WO-2014144678-\$ WO-2014146270-\$ WO- 2014147470-\$ WO-2014161181-\$ WO-2014166039-\$ WO-2014167530-\$ WO-2014169437-\$ WO- 2014169667-\$ WO-2014185937-\$ WO-2014186983-\$ WO-2014194499-\$ WO-2014195687-\$ WO- 2014198042-\$ WO-2014201610-\$ WO-2014201611-\$ WO-2014201646-\$ WO-2014201664-\$ WO- 2014201666-\$ WO-2014201668-\$ WO-2014205749-\$ WO-2014205780-\$ WO-2014205807-\$ WO- 2014205811-\$ WO-2014206148-\$).DID.				
S71	204	(WO-2015000125-\$ WO-2015000180-\$ WO-2015003327-\$ WO-2015003372-\$ WO-2015003374-\$ WO-2015006929-\$ WO-2015010242-\$ WO-2015010277-\$ WO-2015010284-\$ WO-2015010291-\$ WO-2015010310-\$ WO-2015010336-\$ WO-2015010345-\$ WO-2015010349-\$ WO-2015013327-\$ WO-2015013890-\$ WO-2015013891-\$ WO-2015013892-\$ WO-2015013926-\$ WO-2015013950-\$ WO-2015013967-\$ WO-2015015156-\$ WO-2015017971-\$ WO-2015018026-\$ WO-2015018120-\$ WO-2015021612-\$ WO-2015021646-\$ WO-2015021651-\$ WO-2015021652-\$ WO-2015021655-\$ WO-2015021658-\$ WO-2015024239-\$ WO-2015024247-\$ WO-2015026081-\$ WO-2015027383-\$ WO-2015027435-\$ WO-2015027436-\$ WO-2015027470-\$ WO-2015032050-\$ WO-2015032055-\$ WO-2015032078-\$ WO-2015032093-\$ WO-2015035547-\$ WO-2015035557-\$ WO-2015035587-\$ WO-2015035623-\$ WO-2015035689-\$ WO-2015037925-\$ WO-2015039275-\$ WO-2015039280-\$ WO-2015039332-\$ WO-2015042790-\$ WO-2015042811-\$ WO-2015042848-\$ WO-2015042943-\$ WO-2015051509-\$ WO-2015051538-\$ WO-2015054815-\$ WO-2015054961-\$ WO-2015055314-\$ WO-2015058340-\$ WO-2015058341-\$ WO-2015058367-\$ WO-2015058387-\$ WO-2015062041-\$ WO-2015066136-\$ WO-2015066927-\$ WO-2015068044-\$ WO-2015070398-\$ WO-2015070405-\$ WO-2015071703-\$ WO-2015073975-\$ WO-2015074187-\$ WO-	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/13 12:37

		2015074265-\$ WO-2015074308-\$ WO-2015077998-\$ WO-2015077999-\$ WO-2015078010-\$ WO- 2015079197-\$ WO-2015089711-\$ WO-2015091346-\$ WO-2015106434-\$ WO-2015106440-\$ WO- 2015107551-\$ WO-2015107552-\$ WO-2015109476-\$ WO-2015109532-\$ WO-2015109540-\$ WO- 2015109616-\$ WO-2015109618-\$ WO-2015117285-\$ WO-2015120588-\$ WO-2015120591-\$ WO- 2015120623-\$ WO-2015123831-\$ WO-2015127609-\$ WO-2015137815-\$ WO-2015168828-\$ WO- 2015175979-\$ WO-2015193456-\$).DID.				
S72	129	(WO-2016012769-\$ WO-2016020675-\$ WO-2016023651-\$ WO- 2016030661-\$ WO-2016040575-\$ WO-2016041114-\$ WO-2016041140-\$ WO-2016046116-\$ WO- 2016050247-\$ WO-2016058189-\$ WO-2016058992-\$ WO-2016059000-\$ WO-2016059003-\$ WO- 2016062777-\$ WO-2016063775-\$ WO-2016065606-\$ WO-2016071705-\$ WO-2016071706-\$ WO- 2016074230-\$ WO-2016076178-\$ WO-2016079001-\$ WO-2016079152-\$ WO-2016079155-\$ WO- 2016082183-\$ WO-2016090533-\$ WO-2016101200-\$ WO-2016101202-\$ WO-2016101203-\$ WO- 2016110522-\$ WO-2016112491-\$ WO-2016112493-\$ WO-2016127396-\$ WO-2016128562-\$ WO- 2016131755-\$ WO-2016156103-\$ WO-2016156413-\$ WO-2016162492-\$ WO-2016165125-\$ WO- 2016169669-\$ WO-2016169796-\$ WO-2016176800-\$ WO-2016189086-\$ WO-2016193336-\$ WO- 2016193365-\$ WO-2016207357-\$ WO-2017005835-\$ WO-2017015791-\$ WO-2017021536-\$ WO- 2017028295-\$ WO-2017031678-\$ WO-2017036818-\$ WO-2017036819-\$ WO-2017036828-\$ WO- 2017036829-\$ WO-2017036865-\$ WO-2017036879-\$ WO-2017046247-\$ WO-2017046334-\$ WO- 2017055564-\$ WO-2017059571-\$ WO-2017060279-\$ WO-2017064051-\$ WO-2017064322-\$).DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/13 12:37
S73	25	(WO-2017064323-\$ WO-2017064324-\$ WO-2017072239-\$ WO- 2017072277-\$ WO-2017072284-\$ WO-2017081176-\$ WO-2017084920-\$ WO-2017085240-\$ WO- 2017097821-\$ WO-2017108392-\$ WO-2017121546-\$ WO-9712639-\$).DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/13 12:37

S74	2581	S60 S61 S62 S63 S64 S65 S66 S67 S68 S69 S70 S71 S72 S73	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/13 12:37
S75	72	S74 and window	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/13 12:39
S76	199	("20020088469" "20050029137" "20070089757" "20140107815" "20140161301" "20140178461" "20150245655" "20150245657" "20150245665" "20150245666" "20150245667" "20150313283" "20150320116" "20150351455" "20150357608" "20160021771" "20160315488" "5,545,904" "6,743,030" "7,214,075" "7,275,941" "7,905,236" "8,881,738" "9,167,849" D142178 D207887 D250485 D255548 D260690 D271255 D280494 D301837 D302659 D303722 D304771 D310171 D310349 D315032 D336346 D367605 D368552 D371633 D545904 D546782 D547002 D551548 D551970 D556154 D558060 D562151 D565496 D568298 D569727 D571202 D571556 D573474 D576619 D577019 D577150 D577591 D580756 D585077 D589941 D591758 D599670 D605509 D606505 D610588 D616753 D621357 D624880 D627962 D631055 D631458 D634735 D639303 D641718 D645817 D647247 D649708 D661889 D661991 D664146 D664636 D670272 D670659 D672715 D674182 D682841 D684683 D687042 D707627 D708727 D718621 D718723 D718933 D720095 D720496 D720497 D721202 D721972 D722023 D723735 D723736 D724037 D726727 D728855 D729030 D729277 D729444 D729445 D730572 D731114 D733142 D733356 D736706 D737508 D737566 D738038 D739973 D742064 D743099 D744342 D744419 D745004 D746291 D747265 D747603 D747722 D751527 D753090 D755506 D755733 D755735 D757353 D757690 D759031 D759303 D760431 D762003 D763203 D763204 D766873 D767201 D768920 D768980 D769830 D770088 D770395 D772879 D773391 D774514 D776162 D776270 D776338 D776659 D779677 D780179).pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 09:50
S77	2	S76 and window	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2017/09/15 09:51

			EPO; JPO; DERWENT; IBM_TDB			
S78	136	(D142178 D207887 D250485 D255548 D260690 D271255 D280494 D301837 D302659 D303722 D304771 D310171 D310349 D315032 D336346 D367605 D368552 D371633 D545904 D546782 D547002 D551548 D551970 D556154 D558060 D562151 D565496 D568298 D569727 D571202 D571556 D573474 D576619 D577019 D577150 D577591 D580756 D585077 D589941 D591758 D599670 D605509 D606505 D610588 D616753 D621357 D624880 D627962 D631055 D631458 D634735 D639303 D641718 D645817 D647247 D649708 D661889 D661991 D664146 D664636 D670272 D670659 D672715 D674182 D682841 D684683 D687042 D707627 D708727 D718621 D718723 D718933 D720095 D720496 D720497 D721202 D721972 D722023 D723735 D723736 D724037 D726727 D728855 D729030 D729277 D729444 D729445 D730572 D731114 D733142 D733356 D736706 D737508 D737566 D738038 D739973 D742064 D743099 D744342 D744419 D745004 D746291 D747265 D747603 D747722 D751527 D753090 D755506 D755733 D755735 D757353 D757690 D759031 D759303 D760431 D762003 D763203 D763204 D766873 D767201 D768920 D768980 D769830 D770088 D770395 D772879 D773391 D774514 D776162 D776270 D776338 D776659 D779677 D780179).pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 09:51
S79	80	("9101729" "9220302" "9504279" "20060191546" "20080023003" "20130333711" "20140007891" "20140116455" "20140123990" "20140174458" "20140261493" "20140355969" "20150027457" "20150034104" "20150034507" "20150128971" "20150128972" "20150223521" "20160270442" "20160374393").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 10:01
S80	6	(WO-2012062600-\$ WO-2015027435- \$ WO-2016059000-\$).DID.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 10:02
S81	4	(D695450 D707389 D725310 D730571).pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 10:04
S82	90	S79 S80 S81	US-PGPUB;	OR	OFF	2017/09/15

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			10:04
S83	12	S82 and (window or notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2017/09/15 10:04
S84	0	"20150781928".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	OFF	2017/10/25 10:45
S85	0	"201500781928".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	OFF	2017/10/25 10:45
S86	0	"2015781928".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	AND	OFF	2017/10/25 10:45
S87	36	((("MONSEES") near3 ("James"))).INV.	US-PGPUB; USPAT; USOCR	OR	OFF	2018/02/13 09:45
S88	125	((("MONSEES") near3 ("James"))).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 09:45
S89	161219	cannula	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 09:45
S90	5	S88 and S89	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 09:45
S91	12569	A24F47/008.cpc.	US-PGPUB; USPAT; USOCR;	OR	OFF	2018/02/13 10:06

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S92	2437	A24F47/008.cpc. and mouthpiece	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 10:06
S93	32	A24F47/008.cpc. and mouthpiece same (notch or indent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 10:08
S94	2437	A24F47/008.cpc. and mouthpiece	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 10:16
S95	0	A24.cpcl.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 13:19
S96	155576	A24\$.cpcl.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 13:19
S97	2896	S96 and cigarette adj holder	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 13:19
S98	682	S96 and cigarette adj holder same mouthpiece	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 13:20
S99	0	15/813089.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 14:04
S100	0	"15257748".app..app.	US-PGPUB;	OR	OFF	2018/02/13

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:04
S101	1	15/257748.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/13 14:05
S102	3	"20150034104".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 09:13
S103	3	"20170013885".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 09:17
S104	2	"20160174607".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 09:41
S105	2	"20150305409".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/02/16 09:43
S106	0	(US20060191546A1 US20080023003A1 US201303337111A1 US20140116455A1 US20140123990A1 US20140174458A1 US20140261493A1 US20140355969A1 US20150034507A1 US20150128972A1 US20150223521A1 US9101729B2 US9220302B2 US9504279B2 USD260690 USD303722 USD433532 USD500301 USD532927 USD695450S USD707389S USD720095 USD721202 USD725310S USD730571S WO2012062600A1 WO2015027435A1 WO2016059000A1)	USPAT	OR	OFF	2018/03/16 15:36
S107	0	(US20060191546A1 US20080023003A1 US201303337111A1 US20140116455A1 US20140123990A1 US20140174458A1 US20140261493A1 US20140355969A1 US20150034507A1 US20150128972A1 US20150223521A1 US9101729B2 US9220302B2 US9504279B2).pn.	USPAT	OR	OFF	2018/03/16 15:37

S108	0	(20060191546A1 20080023003A1 201303337111A1 20140116455A1 20140123990A1 20140174458A1 20140261493A1 20140355969A1 20150034507A1 20150128972A1 20150223521A1 9101729B2 9220302B2 9504279B2).pn.	USPAT	OR	OFF	2018/03/16 15:37
S109	3	("20060191546" "20080023003" "201303337111" 20140116455A1 "20140123990" 20140174458A1 "20140261493" "20140355969" "20150034507" "20150128972" "20150223521" "9101729" "9220302" "9504279").pn.	USPAT	OR	OFF	2018/03/16 15:38
S110	3	("20060191546" "20080023003" "201303337111" "20140116455" "20140123990" "20140174458" "20140261493" "20140355969" "20150034507" "20150128972" "20150223521" "9101729" "9220302" "9504279").pn.	USPAT	OR	OFF	2018/03/16 15:38
S111	62	("20060191546" "20080023003" "201303337111" "20140116455" "20140123990" "20140174458" "20140261493" "20140355969" "20150034507" "20150128972" "20150223521" "9101729" "9220302" "9504279").pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 15:38
S112	7	S111 and (window or notch or peak)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 15:39
S113	0	W02012062600A1	USPAT	OR	OFF	2018/03/16 16:10
S114	0	W02012062600A1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 16:10
S115	0	W02012062600A1.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 16:11
S116	0	W02012062600A1.did.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 16:11
S117	2	W02012062600A1	US-PGPUB; USPAT; USOCR;	OR	OFF	2018/03/16 16:11

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S118	4	(WO2012062600A1 WO2015027435A1 W02016059000A1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 16:11
S119	2	S118 and (window or notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/16 16:12
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S136	1518	S129 S130 S131 S132 S133 S134 S135	US-PGPUB; USPAT	OR	OFF	2018/03/27 10:17
S137	1518	S136	US-PGPUB; USPAT	OR	OFF	2018/03/27 10:17
S138	584	S136 and mouthpiece	US-PGPUB; USPAT	OR	OFF	2018/03/27 10:17
S139	15359	a24f.cpcl.	US-PGPUB; USPAT	OR	OFF	2018/03/27 11:16
S140	717	S139 and mouthpiece same (notch or window or view)	US-PGPUB; USPAT	OR	OFF	2018/03/27 11:18
S141	463	S139 and mouthpiece near20 (notch or window or view)	US-PGPUB; USPAT	OR	OFF	2018/03/27 11:18
S142	24	S139 and mouthpiece near20 (notch or window)	US-PGPUB; USPAT	OR	OFF	2018/03/27 11:19

S143	102	S139 and mouthpiece same (notch or window)	US-PGPUB; USPAT	OR	OFF	2018/03/27 11:19
S144	972	Cigarette and (square same cross same section)	US-PGPUB; USPAT	OR	OFF	2018/03/28 08:52
S145	1451	Cigarette and (triangle)	US-PGPUB; USPAT	OR	OFF	2018/03/28 08:52
S146	8	Cigarette and (triangle) same shape same roll	US-PGPUB; USPAT	OR	OFF	2018/03/28 08:52
S147	90	shouse.in.	US-PGPUB; USPAT	OR	OFF	2018/03/28 08:57
S148	3	shouse.in. and cigarette	US-PGPUB; USPAT	OR	OFF	2018/03/28 08:57
S149	1	15/257768.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/28 11:44
S150	15359	a24f.cpcl.	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:04
S151	102	S150 and mouthpiece same (notch or window)	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:04
S152	13	S151 and pogo	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:04
S153	35	a24f.cpcl. and pogo	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:05
S154	955	a24f.cpcl. and magnetic	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:08
S155	35	a24f.cpcl. and magnetic same couple	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:08
S156	1517	a24f.cpcl. and channel	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:12
S157	245	a24f.cpcl. and channel same vapor	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:12
S158	258	a24f.cpcl. and (channel or chimney) same vapor	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:19
S159	13	S158 NOT S157	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:19
S160	1379	a24f.cpcl. and reservoir	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:22
S161	344	a24f.cpcl. and reservoir same (passage)	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:23
S162	219	a24f.cpcl. and reservoir same (passage near5 air)	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:23
S163	235	a24f.cpcl. and reservoir same (passage near5 (air or vapor))	US-PGPUB; USPAT	OR	OFF	2018/03/28 12:23
S164	159	atomizer same flow same (chimney or path or channel) same reservoir	US-PGPUB; USPAT	OR	OFF	2018/03/28 14:39
S165	264	atomizer same flow same (chimney or path or channel) same reservoir	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	OFF	2018/03/28 14:40

			IBM_TDB			
S166	1379	a24f.cpcl. and (axial or concentric)	US-PGPUB; USPAT	OR	OFF	2018/03/28 14:49
S167	14	a24f.cpcl. and (axial or concentric) and non-concentric	US-PGPUB; USPAT	OR	OFF	2018/03/28 14:49
S168	1379	a24f.cpcl. and (reservoir)	US-PGPUB; USPAT	OR	OFF	2018/03/28 14:51
S169	2885	a24f.cpcl. and (reservoir)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/28 14:51
S170	1690	a24f.cpcl. and (reservoir) and air	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/03/28 14:53
S171	656	monsees.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/05/10 14:23
S172	148	monsees.in. near3 james.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/05/10 14:23
S173	12	(monsees.in. near3 james.in.) and (mouthpiece same notch)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/05/10 14:24
S174	2	"20060191594".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/06/20 13:41
S175	2	"20130192615".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/06/20 13:44
S176	2	"9247773".pn.	US-PGPUB; USPAT; USOCR; FPRS;	OR	OFF	2018/06/20 13:46

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S177	1	"D723737".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/06/20 13:47
S179	31	(monsees.in. near3 james.in.) and (interior adj surface)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/09/28 12:12
S180	0	(monsees.in. near3 james.in.) and (interior adj surface).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/09/28 12:13
S182	1	15/815643.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/09/28 14:45
S183	1	15/832743.app.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2018/09/28 14:45

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L3	0	(apparatus comprising cartridge mouthpiece storage compartment configured hold vaporizable material heater chamber resistive heating element heat wherein generates aerosol air passing along airflow path body receptacle insertably receive couple disposed receives couples air inlet passage first side formed exterior surface second internal configured deliver fluid connection connecting).clm.	US-PGPUB; USPAT	AND	OFF	2019/12/09 14:08
S53	0	(vaporizer apparatus comprising cartridge having elongate flattened storage compartment configured hold liquid vaporizable material visible through distal end proximal end opening through mouthpiece heater chamber wick within heating resistive element thermal contact opaque body front side back side pair lateral sides extending	US-PGPUB; USPAT	AND	OFF	2017/02/19 14:09

		between prevented rolling placed flat surface because diameter larger receptacle formed edge around notch portion housed).clm.				
S59	0	(vaporizer apparatus comprising cartridge having elongate flattened storage compartment configured hold liquid vaporizable material visible through distal end proximal end opening through mouthpiece heater chamber wick within heating resistive element thermal contact opaque body front side back side pair lateral sides extending between prevented rolling placed flat surface because diameter larger receptacle formed edge around notch portion housed).clm.	US-PGPUB; USPAT	AND	OFF	2017/09/11 10:09
S178	0	(cartridge vaporizer device comprising elongate flattened storage compartment configured hold liquid vaporizable material wherein visible through further distal end proximal first side extending between opaque mouthpiece secured over having front adjacent terminates edge disposed adjacent location between opening second notch extending away from toward exposes region beneath heater heating chamber wick partially within resistive element thermal contact cannula extending surrounds filled visible forms fluid connection opening aerosol formed inhalable).clm.	US-PGPUB; USPAT	AND	OFF	2018/06/20 13:55
S184	0	(apparatus comprising cartridge mouthpiece storage compartment configured hold vaporizable material heater chamber resistive heating element heat wherein generates aerosol air passing along airflow path body receptacle insertably receive couple disposed receives couples air inlet passage first side formed exterior surface second internal configured deliver fluid connection connecting).clm.	US-PGPUB; USPAT	AND	OFF	2019/05/13 08:44

12/ 9/ 2019 2:09:11 PM

C:\Users\mfelton\Documents\EAST\Workspaces\16032009 - 15257768 - 257760 - 257748 e cig cartridge w window.wsp

To: IPDocketingBOS@mintz.com,IPFilerombos@mintz.com,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 148514

Dec 16, 2019 03:40:50 AM

Dear PAIR Customer:

Mintz/JUUL
One Financial Center
Boston, MA 02111
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 148514 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	NOA	12/16/2019	62210-508C18US/716.US18
	1449	12/16/2019	62210-508C18US/716.US18
	1449	12/16/2019	62210-508C18US/716.US18

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

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Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

PRINTER RUSH
(PTO ASSISTANCE)

Application: 16032009

Examiner: Felton

GAU: 1747

From:

Location: IDC

Creation Date: 02/07/2020

Week Date: 12/16/2019

<u>DOC CODE</u>	<u>DOC DATE</u>	<u>MISCELLANEOUS</u>
<div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☒</div><div>1449</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>IDS</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>CLM</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>IIFW/FWCLM</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>SRFW</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>DRW</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>OATH</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>312</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>SPEC</div></div>	<u>12/16/2019</u>	<div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Continuing Data</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Foreign Priority</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Document Legibility</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Fees</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Petition (TC)</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Other</div></div>

[RUSH] Message:

Please provide date(s) for citation CF-JP-11-000093 (1449 12/16/2019, page 14 of 20). Month and year are required for publication. If date(s) is/are not available, please line through citation(s).
Thank You

[XRUSH] Response:

Initials: _____

Examiner: PUBS contact - James Leija, (703) 756-1197

NOTE: This form will be included as part of the official USPTO record with the response document coded as XRUSH.

REV: AUG 16

Page 1/1

NJOY Exhibit 1002.3014

PART B-FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By fax, send to: (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

MINTZ LEVIN COHN FERRIS GLOVSKY AND POPEO, P.C.
3580 Carmel Mountain Road
Suite 300
San Diego, California 92130-6768

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Jeremy Johnston	(Typed or printed name)
/Jeremy Johnston/	(Signature)
March 16, 2020	(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
16/032,009	07/10/2018	James Monsees		7691

TITLE OF INVENTION: VAPORIZER APPARATUS

APPLN: TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1,000.00			\$1,000.00	03/16/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
M. J. Felton	1747	

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363) ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.	1. Mintz Levin Cohn Ferris Glovsky and Popeo, P.C. 2. 3.
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE or COUNTRY)

JUUL Labs, Inc.

San Francisco, California

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government4a. Fees Submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment (Please first reapply any previously paid fee shown above):

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5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29.☐ Applicant asserting small entity status. See 37 CFR 1.27.☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid Certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken as a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken as a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature

/Justin J Leisey/

Date March 16, 2020

Typed or printed name

Justin J. Leisey

Registration No.

65,082

Electronic Patent Application Fee Transmittal				
Application Number:		16032009		
Filing Date:		10-Jul-2018		
Title of Invention:		VAPORIZER APPARATUS		
First Named Inventor/Applicant Name:		James Monsees		
Filer:		Justin James Leisey/Jeremy Johnston		
Attorney Docket Number:		62210-508C18US/716.US18		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt	
EFS ID:	38882512
Application Number:	16032009
International Application Number:	
Confirmation Number:	7691
Title of Invention:	VAPORIZER APPARATUS
First Named Inventor/Applicant Name:	James Monsees
Customer Number:	148514
Filer:	Justin James Leisey/Jeremy Johnston
Filer Authorized By:	Justin James Leisey
Attorney Docket Number:	62210-508C18US/716.US18
Receipt Date:	16-MAR-2020
Filing Date:	10-JUL-2018
Time Stamp:	23:17:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$1000
RAM confirmation Number	E20203FN17458426
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	62210-508C18US-Issue-Fee-Trans-SIGNED.pdf	153902	no	1
			9152ea27a1b6e4c55a86cc70c92ebd48d442aed4		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	29979	no	2
			2daf0f53198d66eb24cf5b468e9b35c15d403a6f		
Warnings:					
Information:					
Total Files Size (in bytes):			183881		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	04/03/2020	EXAMINER	
Mintz/JUUL			FELTON, MICHAEL J	
One Financial Center			ART UNIT	
Boston, MA 02111			PAPER NUMBER	
			1747	
			NOTIFICATION DATE	
			DELIVERY MODE	
			04/03/2020	
			ELECTRONIC	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

IPDocketingBOS@mintz.com
IPFilerombos@mintz.com

Notice of Allowability	Application No. 16/032,009	Applicant(s) Monsees et al.	
	Examiner MICHAEL J FELTON	Art Unit 1747	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to information disclosure statement received 08/21/2019.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 21-50. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☐ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/Michael J Felton/ Primary Examiner, Art Unit 1747	
---	--

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	1	of	20	Attorney Docket Number	62210-508C18US/716.US18

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code ² (if known)			
	A	US-10,039,321	08-07-2018	Verleur et al.	
	B	US-10,045,568	08-14-2018	Monsees et al.	
	C	US-10,058,122	08-28-2018	Steingraber et al.	
	D	US-10,058,124	08-28-2018	Monsees et al.	
	E	US-10,058,129	08-28-2018	Monsees et al.	
	F	US-10,085,481	10-02-2018	Verleur et al.	
	G	US-10,092,713	10-09-2018	Terry et al.	
	H	US-10,111,470	10-30-2018	Monsees et al.	
	I	US-10,117,465	11-06-2018	Monsees et al.	
	J	US-10,117,466	11-06-2018	Monsees et al.	
	K	US-10,143,233	12-04-2018	Dubief et al.	
	L	US-10,195,345	02-05-2019	Senior et al.	
	M	US-10,195,370	02-05-2019	Chen	
	N	US-10,264,823	04-23-2019	Monsees et al.	
	O	US-20020043262-A1	04-18-2002	Langford et al.	
	P	US-20020088469-A1	07-11-2002	Rennecamp	
	Q	US-20030096542-A1	05-22-2003	Kojima	
	R	US-20030150451-A1	08-14-2003	Shayan	
	S	US-20030226837-A1	12-11-2003	Blake et al.	
	T	US-20040050382-A1	03-18-2004	Goodchild	
	U	US-20050029137-A1	02-10-2005	Wang	
	V	US-20050134215	06-23-2005	Bozzzone et al.	
	W	US-20050252511-A1	11-17-2005	Pentafragas	
	X	US-20060141344-A1	06-29-2006	Chen et al.	
	Y	US-20060191546-A1	08-31-2006	Takano et al.	
	Z	US-20060191594-A1	08-31-2006	Py	
	AA	US-20060207466-A1	09-21-2006	McNulty et al.	
	AB	US-20070074734-A1	04-05-2007	Braunshteyn et al.	
	AC	US-20070089757-A1	04-26-2007	Bryman	
	AD	US-20070119450-A1	05-31-2007	Wharton et al.	
	AE	US-20070229025-A1	10-04-2007	Tsai et al.	
	AF	US-20070277816-A1	12-06-2007	Morrison et al.	
	AG	US-20070283972-A1	12-13-2007	Monsees et al.	
	AH	US-20080023003-A1	01-31-2008	Rosenthal	
	AI	US-20080029095-A1	02-07-2008	Esser	
	AJ	US-20080092912-A1	04-24-2008	Robinson et al.	
	AK	US-20080257367-A1	10-23-2008	Paterno et al.	
	AL	US-20080302374-A1	12-11-2008	Wengert et al.	
	AM	US-20090095287-A1	04-16-2009	Emarlou	
	AN	US-20090230117-A1	09-17-2009	Fernando et al.	
	AO	US-20090272379-A1	11-05-2009	THORENS et al.	
	AP	US-20090283103-A1	11-19-2009	Nielsen et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MJF/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	2	of	20	Attorney Docket Number	62210-508C18US/716.US18

	AQ	US-2010/0194337-A1	08-05-2010	OPOLKA	
	AR	US-2010/0253279-A1	10-07-2010	Matthias	
	AS	US-20100031968-A1	02-11-2010	SHEIKH et al.	
	AT	US-20100163063-A1	07-01-2010	FERNANDO et al.	
	AU	US-20100163065-A1	07-01-2010	CHANG	
	AV	US-20100192949-A1	08-05-2010	Wright et al.	
	AW	US-2011/0303231	12-15-2011	Li et al.	
	AX	US-20110094523-A1	04-28-2011	Thorens et al.	
	AY	US-20110125146-A1	05-26-2011	GREELEY et al.	
	AZ	US-20110155153-A1	06-30-2011	Thorens et al.	
	BA	US-20110192397-A1	08-11-2011	Saskar et al.	
	BB	US-20110226236-A1	09-22-2011	Buchberger	
	BC	US-20110265806-A1	11-03-2011	Alarcon et al.	
	BD	US-2012/0223673-A1	09-06-2012	CHEN et al.	
	BE	US-20120018529-A1	01-26-2012	Gammon et al.	
	BF	US-20120048266-A1	03-01-2012	Alelov	
	BG	US-20120188687-A1	07-26-2012	Yamamoto	
	BH	US-20120199146-A1	08-09-2012	Marangos	
	BI	US-20120199663-A1	08-09-2012	QIU	
	BJ	US-20120255546-A1	10-11-2012	Goetz et al.	
	BK	US-20120255567-A1	10-11-2012	Rose et al.	
	BL	US-20120318882-A1	12-20-2012	Abehasera	
	BM	US-2013/0104916-A1	05-02-2013	Bellinger et al.	
	BN	US-20130037041-A1	02-14-2013	Worm et al.	
	BO	US-20130042865-A1	02-21-2013	MONSEES et al.	
	BP	US-20130081642-A1	04-04-2013	Safari	
	BQ	US-20130099725-A1	04-25-2013	Burrell et al.	
	BR	US-20130168880-A1	07-04-2013	DUKE	
	BS	US-20130182421-A1	07-18-2013	Popper et al.	
	BT	US-20130192615-A1	08-01-2013	Tucker et al.	
	BU	US-20130192619-A1	08-01-2013	Tucker et al.	
	BV	US-20130213419-A1	08-22-2013	Tucker et al.	
	BW	US-20130220314-A1	08-29-2013	Bottom	
	BX	US-20130220315-A1	08-29-2013	Conley et al.	
	BY	US-20130220316-A1	08-29-2013	Oglesby et al.	
	BZ	US-20130228191-A1	09-05-2013	Newton	
	CA	US-20130253433-A1	09-26-2013	Senior et al.	
	CB	US-20130255702-A1	10-03-2013	Griffith, JR. et al.	
	CC	US-20130306065-A1	11-21-2013	Thorens et al.	
	CD	US-20130306084-A1	11-21-2013	Flick	
	CE	US-20130319435-A1	12-05-2013	Flick	
	CF	US-20130323941-A1	12-05-2013	Zeliff et al.	
	CG	US-20130333711-A1	12-19-2013	Liu	
	CH	US-2014/0150783-A1	06-05-2014	Liu	
	CI	US-20140007891-A1	01-09-2014	Liu	
	CJ	US-20140014124-A1	01-16-2014	Glasberg et al.	

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	CK	US-20140014126-A1	01-16-2014	Peleg et al.	
	CL	US-20140053856-A1	02-27-2014	Liu	
	CM	US-20140053857-A1	02-27-2014	Liu	
	CN	US-20140053858-A1	02-27-2014	Liu	
	CO	US-20140107815-A1	04-17-2014	LaMothe	
	CP	US-20140116455-A1	05-01-2014	Youn	
	CQ	US-20140123990-A1	05-08-2014	Timmermans	
	CR	US-20140144429-A1	05-29-2014	Wensley et al.	
	CS	US-20140144453-A1	05-29-2014	Capuano et al.	
	CT	US-20140150784-A1	06-05-2014	Liu	
	CU	US-20140161301-A1	06-12-2014	MERENDA	
	CV	US-20140174458-A1	06-26-2014	KATZ	
	CW	US-20140178461-A1	06-26-2014	RIGAS	
	CX	US-20140182610-A1	07-03-2014	Liu	
	CY	US-20140190496-A1	07-10-2014	Wensley et al.	
	CZ	US-20140202454-A1	07-24-2014	Buchberger	
	DA	US-20140224244-A1	08-14-2014	Liu	
	DB	US-20140253144-A1	09-11-2014	Novak, III et al.	
	DC	US-20140261408-A1	09-18-2014	DePiano et al.	
	DD	US-20140261486-A1	09-18-2014	Potter et al.	
	DE	US-20140261490-A1	09-18-2014	Kane	
	DF	US-20140261493-A1	09-18-2014	Smith et al.	
	DG	US-20140261495-A1	09-18-2014	Novak, III et al.	
	DH	US-20140270727-A1	09-18-2014	Ampolini et al.	
	DI	US-20140270729-A1	09-18-2014	DePiano et al.	
	DJ	US-20140270730-A1	09-18-2014	DePiano et al.	
	DK	US-20140276536-A1	09-18-2014	Estes	
	DL	US-20140283858-A1	09-25-2014	Liu	
	DM	US-20140299137-A1	10-09-2014	Kieckbusch et al.	
	DN	US-20140299141-A1	10-09-2014	FLICK	
	DO	US-20140305454-A1	10-16-2014	Rinker et al.	
	DP	US-20140332020-A1	11-13-2014	Li et al.	
	DQ	US-20140332022-A1	11-13-2014	Li et al.	
	DR	US-20140338685-A1	11-20-2014	Amir	
	DS	US-20140345631-A1	11-27-2014	Bowen et al.	
	DT	US-20140345633-A1	11-27-2014	Talon et al.	
	DU	US-20140355969-A1	12-04-2014	Stern	
	DV	US-20140366898-A1	12-18-2014	MONSEES et al.	
	DW	US-20140373857-A1	12-25-2014	Steinberg	
	DX	US-20140376895-A1	12-25-2014	Han	
	DY	US-2015/0118895-A1	04-30-2015	Zheng et al.	
	DZ	US-20150013696-A1	01-15-2015	Plojoux et al.	
	EA	US-20150020831-A1	01-22-2015	Weigensberg et al.	
	EB	US-20150027457-A1	01-29-2015	Janardhan et al.	
	EC	US-20150027460-A1	01-29-2015	Liu	
	ED	US-20150027471-A1	01-29-2015	Feldman et al.	

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	EE	US-20150034104-A1	02-05-2015	Zhou	
	EF	US-20150034507-A1	02-05-2015	Liu	
	EG	US-20150059783-A1	03-05-2015	Liu	
	EH	US-20150059787-A1	03-05-2015	Qiu	
	EI	US-20150070832-A1	03-12-2015	Schneider et al.	
	EJ	US-20150083147-A1	03-26-2015	Schiff et al.	
	EK	US-20150090256-A1	04-02-2015	CHUNG	
	EL	US-20150090281-A1	04-02-2015	Chen	
	EM	US-20150101606-A1	04-16-2015	White	
	EN	US-20150101625-A1	04-16-2015	Newton et al.	
	EO	US-20150101626-A1	04-16-2015	Li et al.	
	EP	US-20150128971-A1	05-14-2015	Verleur et al.	
	EQ	US-20150128972-A1	05-14-2015	Verleur et al.	
	ER	US-20150128976-A1	05-14-2015	Verleur et al.	
	ES	US-20150136158-A1	05-21-2015	Stevens et al.	
	ET	US-20150157055-A1	06-11-2015	Lord	
	EU	US-20150164147-A1	06-18-2015	Verleur et al.	
	EV	US-20150173124-A1	06-18-2015	Qiu	
	EW	US-20150181940-A1	07-02-2015	Liu	
	EX	US-20150181944-A1	07-02-2015	Li et al.	
	EY	US-20150189919-A1	07-09-2015	Liu	
	EZ	US-20150196060-A1	07-16-2015	Wensley et al.	
	FA	US-20150208728-A1	07-30-2015	Lord	
	FB	US-20150208729	07-2015	Monsees et al.	
	FC	US-20150216237-A1	08-06-2015	Wensley et al.	
	FD	US-20150217068-A1	08-06-2015	Wakalopoulos	
	FE	US-20150223521-A1	08-13-2015	Menting et al.	
	FF	US-20150237916-A1	08-27-2015	Farine et al.	
	FG	US-20150245654-A1	09-03-2015	MEMARI et al.	
	FH	US-20150245655-A1	09-03-2015	MEMARI et al.	
	FI	US-20150245657-A1	09-03-2015	MEMARI et al.	
	FJ	US-20150245665-A1	09-03-2015	MEMARI et al.	
	FK	US-20150245666-A1	09-03-2015	MEMARI et al.	
	FL	US-20150245667-A1	09-03-2015	MEMARI et al.	
	FM	US-20150245668-A1	09-03-2015	MEMARI et al.	
	FN	US-20150245669-A1	09-03-2015	CADIEUX et al.	
	FO	US-20150257447-A1	09-17-2015	Sullivan	
	FP	US-20150282526-A1	10-08-2015	Wu	
	FQ	US-20150289565-A1	10-15-2015	CADIEUX et al.	
	FR	US-20150296889-A1	10-22-2015	LIU	
	FS	US-20150305409-A1	10-29-2015	Verleur et al.	
	FT	US-20150313283-A1	11-05-2015	Collett et al.	
	FU	US-20150313287-A1	11-05-2015	VERLEUR et al.	
	FV	US-20150320116-A1	11-12-2015	Bleloch et al.	
	FW	US-20150327595-A1	11-19-2015	Scatterday	
	FX	US-20150335071-A1	11-26-2015	Brinkley et al.	

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	FY	US-20150351455-A1	12-10-2015	LIU	
	FZ	US-20150357608-A1	12-10-2015	Huang	
	GA	US-20150359263-A1	12-17-2015	BELLINGER	
	GB	US-2016/0353804-A1	12-08-2016	LORD	
	GC	US-20160007651-A1	01-14-2016	Ampolini et al.	
	GD	US-20160021933-A1	01-28-2016	THORENS et al.	
	GE	US-20160044962-A1	02-18-2016	THORENS et al.	
	GF	US-20160095356-A1	04-07-2016	Chan	
	GG	US-20160106153-A1	04-21-2016	Zhu	
	GH	US-20160150824-A1	06-02-2016	MEMARI et al.	
	GI	US-20160157523-A1	06-09-2016	LIU	
	GJ	US-20160198768-A1	07-14-2016	Liu	
	GK	US-20160270442-A1	09-22-2016	Liu	
	GL	US-20160278436-A1	09-29-2016	Verleur et al.	
	GM	US-20160331032-A1	11-17-2016	MALGAT et al.	
	GN	US-20160360790-A1	12-15-2016	Calfee et al.	
	GO	US-20160374393-A1	12-29-2016	CHEN	
	GP	US-2017/0197046-A1	07-13-2017	BUCHBERGER	
	GQ	US-20170035115-A1	02-09-2017	MONSEES et al.	
	GR	US-20170095005-A1	04-06-2017	MONSEES et al.	
	GS	US-20170119044-A1	05-04-2017	OLIGSCHLAEGER et al.	
	GT	US-20170156404-A1	06-08-2017	Novak, III et al.	
	GU	US-20170157341-A1	06-08-2017	PANDYA et al.	
	GV	US-20170231276-A1	08-17-2017	MIRONOV et al.	
	GW	US-20170318861-A1	11-09-2017	THORENS	
	GX	US-20170367410-A1	12-28-2017	HON	
	GY	US-20180070644-A1	03-15-2018	Monsees et al.	
	GZ	US-20180177234-A1	06-28-2018	LEE	
	HA	US-20190037926-A1	02-07-2019	QIU	
	HB	US-3,085,145	04-09-1963	Wray	
	HC	US-3,271,719	09-06-1966	Ovshinsky	
	HD	US-3,918,451	11-11-1975	Steil	
	HE	US-3,934,117	01-20-1976	Schladitz	
	HF	US-4,171,000	10-16-1979	Uhle	
	HG	US-4,492,480	01-08-1985	Wadso et al.	
	HH	US-4,548,454	10-22-1985	Zeller et al.	
	HI	US-4,745,705	05-24-1988	Yamamoto et al.	
	HJ	US-4,793,365	12-27-1988	Sensabaugh, Jr. et al.	
	HK	US-4,811,731	03-14-1989	Newell et al.	
	HL	US-4,947,874	08-14-1990	Brooks et al.	
	HM	US-4,947,875	08-14-1990	Brooks et al.	
	HN	US-4,993,436	02-19-1991	Bloom, Jr.	
	HO	US-5,042,509	08-27-1991	Banerjee et al.	
	HP	US-5,117,482	05-26-1992	Hauber	
	HQ	US-5,144,962	09-08-1992	Counts et al.	
	HR	US-5,259,786	11-09-1993	Huang	

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	HS	US-5,261,424	11-16-1993	Sprinkel, Jr.	
	HT	US-5,269,327	12-14-1993	Counts et al.	
	HU	US-5,479,948	01-02-1996	Counts et al.	
	HV	US-5,661,329	08-26-1997	Hiramoto et al.	
	HW	US-5,682,050	10-28-1997	Williams	
	HX	US-5,865,185	02-02-1999	Collins et al.	
	HY	US-6,090,082	07-18-2000	King et al.	
	HZ	US-6,155,268	12-05-2000	Takeuchi	
	IA	US-6,203,339	03-20-2001	Nieminen	
	IB	US-6,283,610	09-04-2001	Alajajian	
	IC	US-6,516,796	02-11-2003	Cox et al.	
	ID	US-6,637,430	10-28-2003	Voges et al.	
	IE	US-6,708,846	03-23-2004	Fuchs et al.	
	IF	US-6,743,030	06-01-2004	Lin et al.	
	IG	US-6,772,756	08-10-2004	Shayan	
	IH	US-7,019,491	03-28-2006	Bozzone et al.	
	II	US-7,173,222	02-06-2007	Cox et al.	
	IJ	US-7,214,075	05-08-2007	He et al.	
	IK	US-7,275,941	10-02-2007	Bushby	
	IL	US-7,318,435	01-15-2008	Pentafragas	
	IM	US-7,646,613	01-12-2010	Ligtenberg et al.	
	IN	US-7,726,320	06-01-2010	Robinson et al.	
	IO	US-7,802,569	09-28-2010	Yeates et al.	
	IP	US-7,905,236	03-15-2011	Bryman et al.	
	IQ	US-7,913,688	03-29-2011	Cross et al.	
	IR	US-8,485,180	07-16-2013	Smutney et al.	
	IS	US-8,522,776	09-03-2013	Wright et al.	
	IT	US-8,528,569	09-10-2013	Newton	
	IU	US-8,752,545-B2	06-17-2014	Buchberger	
	IV	US-8,833,364	09-16-2014	Buchberger	
	IW	US-8,881,738	11-11-2014	Bryman	
	IX	US-8,893,726-B2	11-25-2014	Hon	
	IY	US-8,897,628	11-25-2014	Conley et al.	
	IZ	US-8,991,402	03-31-2015	Bowen et al.	
	JA	US-9,010,335	04-21-2015	Scatterday	
	JB	US-9,072,321	07-07-2015	Liu	
	JC	US-9,078,473	07-14-2015	Worm et al.	
	JD	US-9,101,729-B2	08-11-2015	Liu	
	JE	US-9,132,248	09-15-2015	Qiu	
	JF	US-9,167,849	10-27-2015	Adamic	
	JG	US-9,220,302	12-29-2015	DePiano et al.	
	JH	US-9,247,773	02-02-2016	Memari et al.	
	JI	US-9,271,529	03-01-2016	Alima	
	JJ	US-9,282,772	03-15-2016	Tucker et al.	
	JK	US-9,289,014	03-22-2016	Tucker et al.	
	JL	US-9,345,541	05-24-2016	Greeley et al.	

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	JM	US-9,386,805	07-12-2016	Liu	
	JN	US-9,408,416	08-09-2016	Monsees et al.	
	JO	US-9,414,629	08-16-2016	Egoyants et al.	
	JP	US-9,420,829	08-23-2016	Thorens et al.	
	JQ	US-9,423,152	08-23-2016	Ampolini et al.	
	JR	US-9,427,022	08-30-2016	Levin et al.	
	JS	US-9,498,588	11-22-2016	Benassayag et al.	
	JT	US-9,504,279	11-29-2016	Chen	
	JU	US-9,510,623	12-06-2016	Tucker et al.	
	JV	US-9,516,899	12-13-2016	Plojoux et al.	
	JW	US-9,526,273	12-27-2016	Liu	
	JX	US-9,549,573	01-24-2017	Monsees et al.	
	JY	US-9,609,893	04-04-2017	Novak, III et al.	
	JZ	US-9,675,109	06-13-2017	Monsees et al.	
	KA	US-9,714,878	07-25-2017	Powers et al.	
	KB	US-9,723,877	08-08-2017	Wong et al.	
	KC	US-9,772,245	09-26-2017	Besling et al.	
	KD	US-9,781,953	10-10-2017	Verleur et al.	
	KE	US-9,795,168	10-24-2017	Zhu	
	KF	US-9,801,413	10-31-2017	Zhu	
	KG	US-9,814,263	11-14-2017	Cochand et al.	
	KH	US-9,814,265	11-14-2017	Rinker et al.	
	KI	US-9,844,234	12-19-2017	Thorens et al.	
	KJ	US-9,861,135	01-09-2018	Chen	
	KK	US-9,974,743	05-22-2018	Rose et al.	
	KL	US-D143295	12-25-1945	Fisher	
	KM	US-D260690	09-08-1981	Stutzer	
	KN	US-D267590	01-11-1983	Varma	
	KO	US-D280494	09-10-1985	Abel	
	KP	US-D299066	12-20-1988	Newell et al.	
	KQ	US-D303722	09-26-1989	Marlow et al.	
	KR	US-D310349	09-04-1990	Rowen	
	KS	US-D336346	06-08-1993	Miller et al.	
	KT	US-D368552	04-02-1996	Adams	
	KU	US-D371633	07-09-1996	Chenard	
	KV	US-D379810	06-10-1997	Giordano, Jr. et al.	
	KW	US-D382146	08-12-1997	Sandy	
	KX	US-D397504	08-25-1998	Zelenik	
	KY	US-D398150	09-15-1998	Vonarburg	
	KZ	US-D405007	02-02-1999	Naas, Sr.	
	LA	US-D405413	02-09-1999	Segers	
	LB	US-D411332	06-22-1999	Zelenik	
	LC	US-D412279	07-27-1999	Brice	
	LD	US-D422884	04-18-2000	Lafond	
	LE	US-D424236	05-02-2000	Reed	
	LF	US-D433532	11-07-2000	Higgins et al.	

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	LG	US-D450313	11-13-2001	Koinuma	
	LH	US-D450662	11-20-2001	Kwok	
	LI	US-D478569	08-19-2003	Hussaini et al.	
	LJ	US-D478897	08-26-2003	Tsuge	
	LK	US-D500301	12-28-2004	Deguchi	
	LL	US-D500302	12-28-2004	Deguchi	
	LM	US-D505922	06-07-2005	Mayo et al.	
	LN	US-D506447	06-21-2005	Mayo et al.	
	LO	US-D506731	06-28-2005	Mayo et al.	
	LP	US-D507244	07-12-2005	Mayo et al.	
	LQ	US-D523171	06-13-2006	Mitten et al.	
	LR	US-D525948	08-01-2006	Blair et al.	
	LS	US-D528992	09-26-2006	Hobart et al.	
	LT	US-D529044	09-26-2006	Andre et al.	
	LU	US-D530340	10-17-2006	Andre et al.	
	LV	US-D531190	10-31-2006	Lee et al.	
	LW	US-D532927	11-28-2006	Sann	
	LX	US-D534921	01-09-2007	Andre et al.	
	LY	US-D535261	01-16-2007	Daniels	
	LZ	US-D535308	01-16-2007	Andre et al.	
	MA	US-D539813	04-03-2007	Chen	
	MB	US-D540749	04-17-2007	Kaule	
	MC	US-D545303	06-26-2007	Chang	
	MD	US-D545490	06-26-2007	Tai	
	ME	US-D545904	07-03-2007	Chen et al.	
	MF	US-D546782	07-17-2007	Poulet et al.	
	MG	US-D556154	11-27-2007	Poulet et al.	
	MH	US-D557209	12-11-2007	Ahlgren et al.	
	MI	US-D558060	12-25-2007	{hacek over (S)}ir et al.	
	MJ	US-D566709	04-15-2008	Kim et al.	
	MK	US-D568298	05-06-2008	Lundgren et al.	
	ML	US-D571556	06-24-2008	Raile	
	MM	US-D573474	07-22-2008	Beam et al.	
	MN	US-D576619	09-09-2008	Udagawa et al.	
	MO	US-D577019	09-16-2008	Udagawa et al.	
	MP	US-D577150	09-16-2008	Bryman et al.	
	MQ	US-D579934	11-04-2008	Okamoto et al.	
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	MS	US-D589941	04-07-2009	Maier et al.	
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	CA	EP-2614731-A1	07-17-2013	Shenzhen First Union Technology Co., Ltd		
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	CE	GB-2504074-A	01-22-2014	Nicoventures Holdings Ltd		
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	CU	WO-2013068100-A1	05-16-2013	Philip Morris Prod		
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	CZ	WO-2013093695-A1	06-27-2013	Sis Resources Ltd		
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	DR	WO-2015054862-A1	04-23-2015	Kimree Hi Tech Inc		
	DS	WO-2015077645-A1	05-28-2015	Corr-tech Associates, Inc		
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	DY	WO-2017173951-A1	10-12-2017	Changzhou Jwei Intelligent Tech Co Ltd		
	DZ	WO-D79112-0010	12-21-2012	Philip Morris Products		
	EA	EP-3000245	08-28-2016	Nu Mark Innovations LTD.		

Examiner Signature		Date Considered	
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NON PATENT LITERATURE DOCUMENTS				
Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.		T ²
	A	"2011 New Eigarette GS-360,With 1.2ml Clearomizer(Id:5861467) Product Details - View 2011 New Eigarette GS-360,With 1.2ml Clearomizer from Green Sound High-Tech Co.,Ltd - EC21." EC21, Global B2B Marketplace - Connecting Global Buyers with Manufacturers, Suppliers, Exporters Worldwide, (2011), wo1138.en.ec21.com/2011_New_Eigarette_GS-360_With--5366965_5861467.html.		
	B	"Electronic Cigarette Refillable Cartridge GS-PUSH,Hold 1.5ml(Id:5722612) Product Details - View Electronic Cigarette Refillable Cartridge GS-PUSH,Hold 1.5ml from Green Sound High-Tech Co.,Ltd - EC21." EC21, Global B2B Marketplace - Connecting Global Buyers with Manufacturers, Suppliers, Exporters Worldwide, (2011), wo1138.en.ec21.com/Electronic_Cigarette_Refillable_Cartridge_GS--5366965_5722612.html.		
	C	"Esteam and J-Series Owner's Manual." Allbrands.com, 2002, www.allbrands.com/misc_files/pdfs/JiffySteamerOwnersManual.pdf .		
	D	"Hacking the Vuse Eig to Fully Use Cartridges and Allow Refills." Hacking the Vuse Eig to Fully Use Cartridges and Allow Refills, 16 Oct. 2015, se.azinstall.net/2015/10/hacking-vuse-eig-puffounter.html?m=1".		
	E	"Lenmar CB0104 Battery for Panasonic Cordless Phones." Amazon, Amazon, first reviewed January 5, 2011, www.amazon.com/LenmarB0104-Battery-Panasoniccordless/dp/B000BS6078/.		
	F	"New Tank Eigarette:innokin 510T." From China Manufacturer, Manufactory, Factory and Supplier on ECVV.com, November 15, 2011, www.ecvv.com/product/3118191.html		
	G	"Terminal and Splices Selection Guide." TE.com, TE, 2013, www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtv&DocNm=2-1773700-5TerminalAndSplicesSelection&DocType=DS&DocLang=English&s_cid=1046 .		
	H	"Uniden BT-990 Cordless Phone Battery NiD, 3.6 Volt, 800 MAh - Ultra Hiapacity - Replacement for Uniden BP-990, Toshiba, GE TL96550, TL96556, Panasonic HHR-P505 Rechargeable Batteries." Amazon, Amazon, first reviewed on February 8, 2017, www.amazon.com/Uniden-BT-990ordless-Phone-Battery/dp/B01HDV75YW.		
	I	513official4. "Glade Plug-Ins Scented Oils 2001." YouTube, YouTube, 29 June 2011, www.youtube.com/watch?v=zW9acp4NOK8.		
	J	CannabisReviewTV™. "Official: Cloud Vape Pen Review #CRTV420." YouTube, YouTube, 17 Apr. 2013, www.youtube.com/watch?v=oujMMZ6l_tA&has_verified=1		
	K	Cedar Board by the home depot. earliest review dated sept 7, 2016. found online [3/19/2019] https://www.homedepot.com/p/1-in-x-4-in-x-8-ft-S1S2Eedar-Board-6-Pack-WRC148T6PK/300194383		
	L	chinabuye. "Innokin ITaste VV Tank Starter Kit Electronic Cigarette with Clearomizer." YouTube, YouTube, 23 July 2013, www.youtube.com/watch?v=mz414d8MU20.		
	M	Cloud pen vaporizer unboxing review by vaporizer blog // VaporizerBlog.com, https://www.youtube.com/watch?v=ixHMKxoWKNg, published on Dec. 12, 2013.		
	N	cutlerylover. "Eletronic Cigarette (Vaping) Review : HALO G6 Basic Starter Kit." YouTube, YouTube, 10 Oct. 2012, www.youtube.com/watch?v=kUprxsQUPCU		
	O	Darth Vapor Reviews. "Halo Cigs: Triton Starter Kit Review." YouTube, YouTube, 11 Aug.		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MJF/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	18	of	20	Attorney Docket Number	62210-508C18US/716.US18

		2013, www.youtube.com/watch?v=KkVzsGsDDMY .	
P		Discount Office Supplies, Office Paper Products Legal Supplies, www.bulkofficesupply.com/Products/Baumgartens-Single-Hole-Trap-Door-Pencil-Sharpener-with-Eraser_BAU19550.aspx , retrieved March 17, 2019.	
Q		El Mono Vapeador. "EVic Joyetech - Revision." YouTube, YouTube, 12 Dec. 2012, www.youtube.com/watch?v=WNLVfgwb4Gs .	
R		Electronic Vaporization Device JUUL JUUL Vapor, posted at juulvapor.com < http://juulvapor.com >, posting date not given, © 2015 Juulvapor.com < http://Juulvapor.com > [online] [site visited 11/24/2015]. Available from Internet, < https://www.juulvapor.com/shop-juul/ >	
S		Engadget. Juul is the eig that will finally stop me from smoking (I hope). [online], published on June 3, 2015. Available at: https://www.engadget.com/2015/06/03/pax-labs-juul-ecigarette/#/ .	
T		EnsembleIQ, "Vuse Product Reel," Youtube, June 6, 2013, https://www.youtube.com/watch?v=lgo_bBY8tNM	
U		Following the Vapor Trail, https://www.nytimes.com/2013/12/19/fashion/for-vaporizers-new-technologynd-product-design.html	
V		Fragrance, Purity. "Purity Home Fragrance - How to Refill Your Plug in Air Freshener.wmv." YouTube, YouTube, 4 June 2012, www.youtube.com/watch?v=OreNgPBUwaY&t=66s .	
W		Frakes, Dan. "Lightning: the iPhone's New Connector." Macworld, Macworld, 13 Sept. 2012, www.macworld.com/article/1168555/whatpples-new-lightningconnector-means-forou.html .	
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Y		Glory Vapes. "Glory Vapes TV: Kanger S1 Cubica Series Starter Kit Unboxing." YouTube, YouTube, 8 Aug. 2013, www.youtube.com/watch?v=NQjvJ6YhdbA .	
Z		infocentre101. "Jiffy Steamer ...No1 Seller." YouTube, YouTube, 31 Dec. 2011, www.youtube.com/watch?v=9ge8phdU6WY .	
AA		iWand Rectangular Pen Shape Design Flat Short Mouth Holder 1.0ML Tank Atomizer LED Display 800mAh Rechargeable E - Cigarette Set - COLORFUL, https://www.gearbest.com/electroniccigarettes/pp_15466.html , accessed Jan. 25, 2019.	
AB		Joye eGo-Tank System XXL 1000mAh Starter Kit, https://www.myvaporstore.com/eGo-Tank-System-XXL-1000mAh-Starter-Kit-p/ego-t-xxlkit.htm , accessed Jan. 25, 2019.	
AC		Maiocco, Roberto. "Modello IWand." YouTube, YouTube, 28 Dec. 2012, www.youtube.com/watch?v=_brOOLDqHX0 .	
AD		Making a box for my Straight Razor by Mr. Mars Experience. dated Jan 22, 2014. found online [3/19/2019] https://www.youtube.com/watch?v=Z7iAx2QoKD0	
AE		Marino, Michelle. "Review - Glade PlugIns Scented Oil Fragrancers." YouTube, YouTube, 18 Feb. 2013, www.youtube.com/watch?v=izEpGdwKSA4 .	
AF		Pentel Multi 8 Color Lead Refill by Pentel on Amazon. earliest review dated Nov 7, 2014. found online [3/22/2019] https://www.amazon.com/Pentel-Multi-Refill-VioletH2-Vdp/B00KQTBPCW/ref=sr_1_15?keywords=Pentel+Multi+8&qid=1558643586&s=gateway&sr=8-15	
AG		Pierce, D. This Might Just Be the First Great Eig. {online} WIRED, Published on April 21, 2015. Available at: https://www.wired.com/2015/04/pax-juul-ecig/?mbid=social_twitter	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /MJF/

Used in Lieu of PTO/SB/08A/B
(Based on PTO 11-07 version)

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	19	of	20	Attorney Docket Number	62210-508C18US/716.US18

	AH	Prater, Bill. "Crown Seven Hydro Imperial Menthol Review." YouTube, YouTube, 12 Jan. 2013, www.youtube.com/watch?v=YTcf6mEa0 .	
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	AJ	Purity Home Fragrance - How to refill your plug in air freshener.wmv, https://www.youtube.com/watch?v=OreNgPBUwaY&t=66s , June 4, 2012.	
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	AM	Smith, Chris. "Next USB Connector Will Finally Be Reversible, like Apple's Lightning Plug." BGR, 5 Dec. 2013, bgr.com/2013/12/05/reversiblesbonconnectorpple-lightning/ .	
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	AR	VapeandBake. "NJOY Electronic Cigarette Review." YouTube, YouTube, 9 Apr. 2013, www.youtube.com/watch?v=qUynQFK_Xpo .	
	AS	Vaporizers Reviewed. "AtmosRX Optimus 510 Vaporizer Review." YouTube, YouTube, 10 Oct. 2013, www.youtube.com/watch?v=wsyQncG8FB8 .	
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	AX	WSP Traditional Straight Razor Coffin by WSP. earliest review dated July 7, 2015. found online [3/18/2019] https://www.amazon.com/WSP-Traditional-Straight-Razoroffin/dp/B00FL2R4BA/ref=sr_1_fkmrnull_3?keywords=WSP+Traditional+Straight+razor+coffin&qid=1558643115&s=gateway&sr=8-3-fkmrnull	

Examiner Signature	/Michael J Felton/	Date Considered	03/24/2020
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<div>Substitute for form 1449/PTO</div> <div>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</div> <div><i>(Use as many sheets as necessary)</i></div>				Complete if Known	
				Application Number	16/032,009
				Filing Date	July 10, 2018
				First Named Inventor	James Monsees
				Art Unit	1747
				Examiner Name	M. J. Felton
Sheet	20	of	20	Attorney Docket Number	62210-508C18US/716.US18

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹Applicant's unique citation designation number (optional). ²Applicant is to place a check mark here if English language Translation is attached.

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PRINTER RUSH
(PTO ASSISTANCE)

Application: 16032009

Examiner: Felton

GAU: 1747

From:

Location: IDC

Creation Date: 02/07/2020

Week Date: 12/16/2019

<u>DOC CODE</u>	<u>DOC DATE</u>	<u>MISCELLANEOUS</u>
<div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☒</div><div>1449</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>IDS</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>CLM</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>IIFW/FWCLM</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>SRFW</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>DRW</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>OATH</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>312</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>SPEC</div></div>	<u>12/16/2019</u>	<div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Continuing Data</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Foreign Priority</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Document Legibility</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Fees</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Petition (TC)</div></div> <div style="display: flex; justify-content: space-between;"><div style="width: 20px; text-align: center;">☐</div><div>Other</div></div>

[RUSH] Message:

Please provide date(s) for citation CF-JP-11-000093 (1449 12/16/2019, page 14 of 20). Month and year are required for publication. If date(s) is/are not available, please line through citation(s).
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[XRUSH] Response:

I added the year for the document
(01/1999) .

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Examiner: PUBS contact - James Leija, (703) 756-1197

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Page 1/1

NJOY Exhibit 1002.3042

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	NOA	04/03/2020	62210-508C18US/716.US18
	1449	04/03/2020	62210-508C18US/716.US18

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	04/14/2020	EXAMINER	
Mintz/JUUL			FELTON, MICHAEL J	
One Financial Center			ART UNIT	
Boston, MA 02111			PAPER NUMBER	
			1747	
			NOTIFICATION DATE	
			DELIVERY MODE	
			04/14/2020	
			ELECTRONIC	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Commissioner for Patents
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P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Application No. : 16032009
Applicant : Monsees
Filing Date : 07/10/2018
Date Mailed : 04/14/2020

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
"Mail Stop Issue Fee, Commissioner for Patents,
P.O. Box 1450, Alexandria, VA 22313-1450".*

/Marsha Palmer-Lee/
Publication Branch
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(571) 272-4200

IDENTIFICATION OF SPECIFICATION/DRAWING INCONSISTENCIES

- ☒ On Page 26 last line, page 27 line 13 of the specification there is a brief description of FIG. 32A-L, 33F, but the drawings filed 07/10/2018 do not include a drawing with that designation. Applicant must respond either by supplying the omitted drawing or by amending the specification to remove all references to that drawing.
- ☐ The drawings filed include FIG. , but the specification's brief description of the drawings does not describe a drawing with that designation. Applicant must respond either by amending the specification to add a brief description of that drawing or by correcting the drawings to remove the drawing in question.
- ☐ In the utility application, drawings are present in the application and are referred to in the detailed description of the invention, but the specification does not contain a brief description of the several views as required by 37 CFR 1.74 and 37 CFR 1.77(b)(9).
- ☐ The design application does not contain a description of the figure or figures of the drawing as required by 37 CFR 1.153(a) and 37 CFR 1.154(b)(4).
- ☐ In the plant application, the specification does not contain a brief description of the drawing as required by 37 CFR 1.163(c)(8).
- ☐ Page of the specification refers to FIG. , but no drawing with that designation is described in the brief description of the drawings and no drawing with that designation is present in the application. Applicant must respond either by amending the specification to remove all references to that drawing, or by supplying that drawing and amending the specification to add a brief description of it.
- ☐ In the reissue application, FIG. , is labeled as "New" but is not described in the reissue specification's brief description of the drawings. Applicant must respond by amending the reissue specification's brief description of the drawings to add a brief description of the new drawing.
- ☐ OTHER:
- ☐ COMMENTS:

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	M327	04/14/2020	62210-508C18US/716.US18

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
James Monsees et al.

Allowed: December 16, 2019

Application No.: 16/032,009

Confirmation No.: 7691

Filed: July 10, 2018

Art Unit: 1747

For: VAPORIZER APPARATUS

Examiner: Michael J. Felton

RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir or Madam:

In response to the Notice to File Corrected Application Papers mailed April 14, 2020, please amend the above-identified application as follows.

Amendments to the Specification begin on page 2 of this paper.

Remarks begin on page 3 of this paper.

AMENDMENTS TO THE SPECIFICATION

Please amend the paragraphs [0126] and [0128] of the specification of the application as-filed as follows. Additions are shown underlined, and deletions are shown in strikethrough text or using double brackets as appropriate.

[0126] FIGS. 31A-31L show cartridges for use with a vaporizer device that each include an opaque mouthpiece that is secured over the proximal end of the transparent storage compartment, and one or more notches in the front side of the mouthpiece that exposes a region of the storage compartment beneath the mouthpiece. In FIGS. ~~32A-32L~~ 31A-31L the central cannula passing through the storage compartment is visible through the notch and the region below the opaque mouthpiece.

[0128] FIGS. 34A-34L illustrate examples of vaporizer devices similar to that shown in FIG. 33A-
[[33F]] 33E, in which the notched regions of the cartridge and the vaporizer are different, but provide a window into the inside of the storage compartment, showing the central cannula and the level of any fluid vaporizable material therein.

REMARKS

In response to the Notice to File Corrected Application Papers, Applicant submits amendments to the Specification to correct references to FIGS. 31A-L and FIG. 33E. No new matter is added.

No additional fees are believed to be due at this time. However, the Commissioner is hereby authorized to charge any fees that may be due, or credit any overpayment of same, to Deposit Account No. 50-0311, Reference No. 16/032,009. If there are any questions regarding this Amendment, the Examiner is encouraged to contact the undersigned at the telephone number provided below.

Dated: April 16, 2020

Respectfully submitted,

Electronic signature: /Justin J Leisey/
Justin J. Leisey
Registration No.: 65,082
MINTZ LEVIN COHN FERRIS
GLOVSKY AND POPEO, P.C.
3580 Carmel Mountain Road, Suite 300
San Diego, California 92130-6768
(858) 314-1500 || (858) 314-1501 (Fax)
Attorney for Applicant



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	04/14/2020	EXAMINER	
Mintz/JUUL			FELTON, MICHAEL J	
One Financial Center			ART UNIT	
Boston, MA 02111			PAPER NUMBER	
			1747	
			NOTIFICATION DATE	
			DELIVERY MODE	
			04/14/2020	
			ELECTRONIC	

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Application No. : 16032009
Applicant : Monsees
Filing Date : 07/10/2018
Date Mailed : 04/14/2020

NOTICE TO FILE CORRECTED APPLICATION PAPERS

Notice of Allowance Mailed

This application has been accorded an Allowance Date and is being prepared for issuance. The application, however, is incomplete for the reasons below.

Applicant is given two (2) months from the mail date of this Notice within which to respond. This time period for reply is extendable under 37 CFR 1.136(a) for only TWO additional MONTHS.

The informalities requiring correction are indicated in the attachment(s). If the informality pertains to the abstract, specification (including claims) or drawings, the informality must be corrected with an amendment in compliance with 37 CFR 1.121 (or, if the application is a reissue application, 37 CFR 1.173). Such an amendment may be filed after payment of the issue fee if limited to correction of informalities noted herein. See Waiver of 37 CFR 1.312 for Documents Required by the Office of Patent Publication, 1280 Off. Gaz. Patent Office 918 (March 23, 2004). In addition, if the informality is not corrected until after payment of the issue fee, for purposes of 35 U.S.C. 154(b)(1)(iv), "all outstanding requirements" will be considered to have been satisfied when the informality has been corrected. A failure to respond within the above-identified time period will result in the application being ABANDONED.

See attachment(s).

*A copy of this notice **MUST** be returned with the reply. Please address response to
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/Marsha Palmer-Lee/
Publication Branch
Office of Data Management
(571) 272-4200

IDENTIFICATION OF SPECIFICATION/DRAWING INCONSISTENCIES

- ☒ On Page 26 last line, page 27 line 13 of the specification there is a brief description of FIG. 32A-L, 33F, but the drawings filed 07/10/2018 do not include a drawing with that designation. Applicant must respond either by supplying the omitted drawing or by amending the specification to remove all references to that drawing.
- ☐ The drawings filed include FIG. , but the specification's brief description of the drawings does not describe a drawing with that designation. Applicant must respond either by amending the specification to add a brief description of that drawing or by correcting the drawings to remove the drawing in question.
- ☐ In the utility application, drawings are present in the application and are referred to in the detailed description of the invention, but the specification does not contain a brief description of the several views as required by 37 CFR 1.74 and 37 CFR 1.77(b)(9).
- ☐ The design application does not contain a description of the figure or figures of the drawing as required by 37 CFR 1.153(a) and 37 CFR 1.154(b)(4).
- ☐ In the plant application, the specification does not contain a brief description of the drawing as required by 37 CFR 1.163(c)(8).
- ☐ Page of the specification refers to FIG. , but no drawing with that designation is described in the brief description of the drawings and no drawing with that designation is present in the application. Applicant must respond either by amending the specification to remove all references to that drawing, or by supplying that drawing and amending the specification to add a brief description of it.
- ☐ In the reissue application, FIG. , is labeled as "New" but is not described in the reissue specification's brief description of the drawings. Applicant must respond by amending the reissue specification's brief description of the drawings to add a brief description of the new drawing.
- ☐ OTHER:
- ☐ COMMENTS:

Electronic Acknowledgement Receipt	
EFS ID:	39180834
Application Number:	16032009
International Application Number:	
Confirmation Number:	7691
Title of Invention:	VAPORIZER APPARATUS
First Named Inventor/Applicant Name:	James Monsees
Customer Number:	148514
Filer:	Justin James Leisey/Matthew Tupper
Filer Authorized By:	Justin James Leisey
Attorney Docket Number:	62210-508C18US/716.US18
Receipt Date:	16-APR-2020
Filing Date:	10-JUL-2018
Time Stamp:	20:50:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		62210-508C18US_Response.pdf	111624	yes	3
			0dedf2f1a7688ea944629bd58ce2ed981bd67275		

	Multipart Description/PDF files in .zip description								
	Document Description		Start	End					
	Applicant Response to Pre-Exam Formalities Notice		1	1					
	Specification		2	2					
	Applicant Arguments/Remarks Made in an Amendment		3	3					
Warnings:									
Information:									
2	Post Allowance Communication - Incoming	MiscLetter.pdf	124820	no	3				
			e393c5bae0004da08f5f6f474bea4ee69392141d						
Warnings:									
Information:									
Total Files Size (in bytes):			236444						
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>									



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16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	06/12/2020		
Mintz/JUUL One Financial Center Boston, MA 02111			EXAMINER FELTON, MICHAEL J	
			ART UNIT 1747	PAPER NUMBER
			NOTIFICATION DATE 06/12/2020	DELIVERY MODE ELECTRONIC

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Response to Rule 312 Communication	Application No. 16032009	Applicant(s)
	Examiner	Art Unit
<p align="center">-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --</p> <p>1. ☒ The amendment filed on <u>04/26/2020</u> under 37 CFR 1.312 has been considered, and has been:</p> <p>a) ☒ entered.</p> <p>b) ☐ entered as directed to matters of form not affecting the scope of the invention.</p> <p>c) ☐ disapproved because the amendment was filed after the payment of the issue fee. Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.</p> <p>d) ☐ disapproved. See explanation below.</p> <p>e) ☐ entered in part. See explanation below.</p> <p> Bernice Crittenden Publishing Division Office of Data Management</p>		

To: mintzdocketing@cpaglobal.com,IPDocketingBOS@mintz.com,IPFilerombos@mintz.com
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Jun 12, 2020 03:51:23 AM

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	N271	06/12/2020	62210-508C18US/716.US18

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/10/2018	James Monsees	62210-508C18US/716.US18	7691
148514	7590	06/17/2020		
Mintz/JUUL One Financial Center Boston, MA 02111			EXAMINER FELTON, MICHAEL J	
			ART UNIT	PAPER NUMBER
			1747	
			NOTIFICATION DATE	DELIVERY MODE
			06/17/2020	ELECTRONIC

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Jun 17, 2020 03:46:42 AM

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	N271	06/17/2020	62210-508C18US/716.US18

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/032,009	07/14/2020	10709173	62210-508C18US/716.US18	7691
148514	7590	06/24/2020		
Mintz/JUUL One Financial Center Boston, MA 02111				

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

James Monsees, San Francisco, CA;
JUUL Labs, Inc., San Francisco, CA;
Adam Bowen, San Francisco, CA;
Steven Christensen, San Francisco, CA;
Joshua Morenstein, San Francisco, CA;
Christopher Nicholas HibmaCronan, Oakland, CA;

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Application	Document	Mailroom Date	Attorney Docket No.
16032009	ISSUE.NTF	06/24/2020	62210-508C18US/716.US18

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