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**SHEIKH et al.**(10) **Pub. No.: US 2010/0031968 A1**(43) **Pub. Date: Feb. 11, 2010**(54) **METHOD AND APPARATUS RELATING TO  
ELECTRONIC SMOKING-SUBSTITUTE  
DEVICES**(30) **Foreign Application Priority Data**

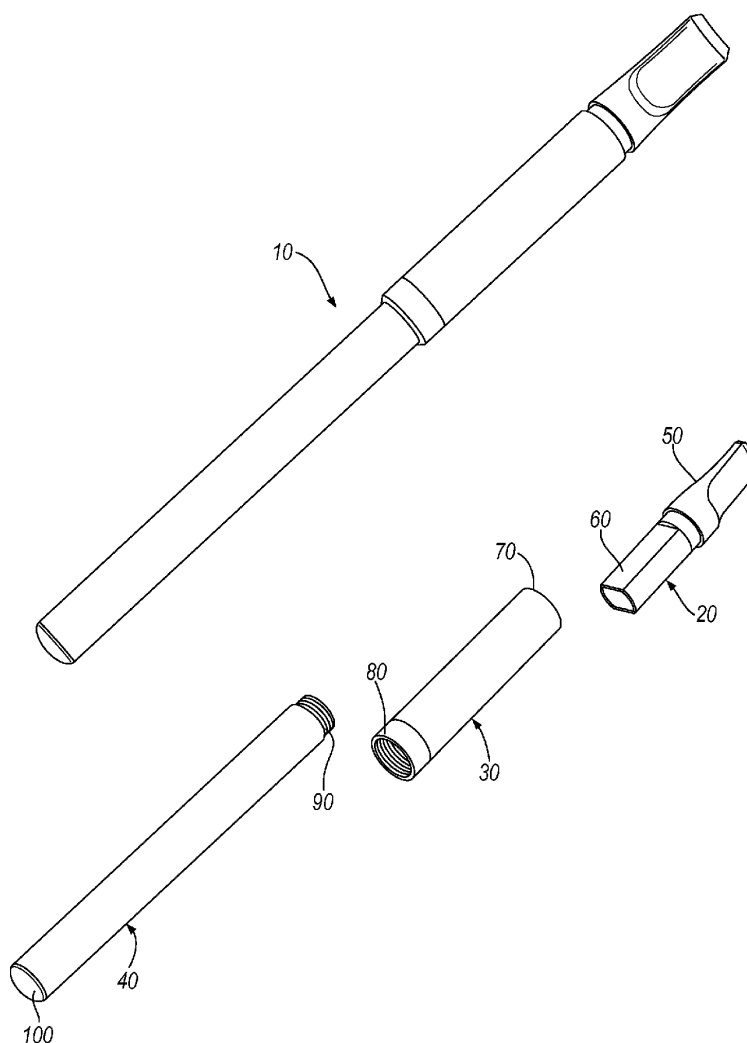
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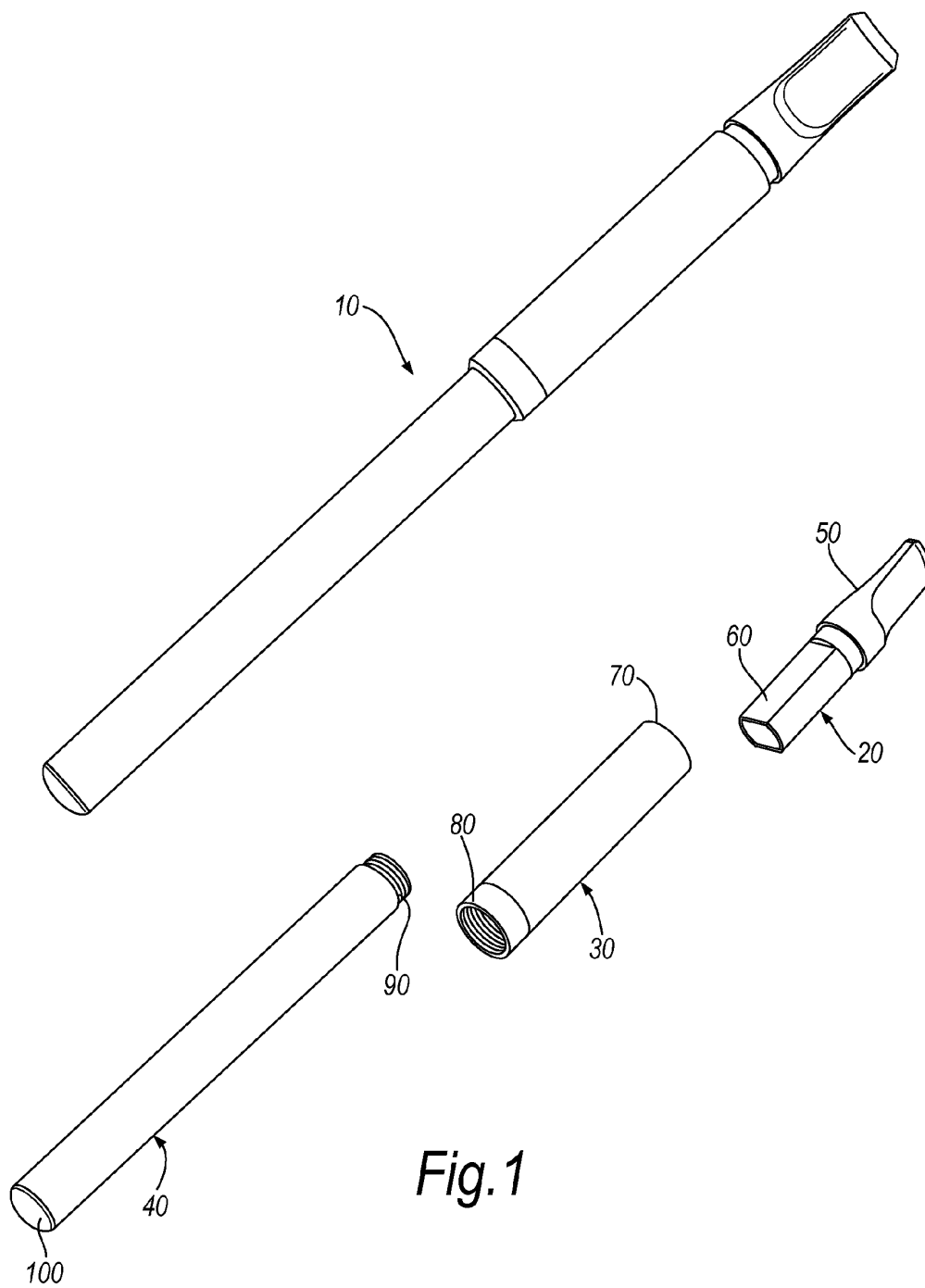
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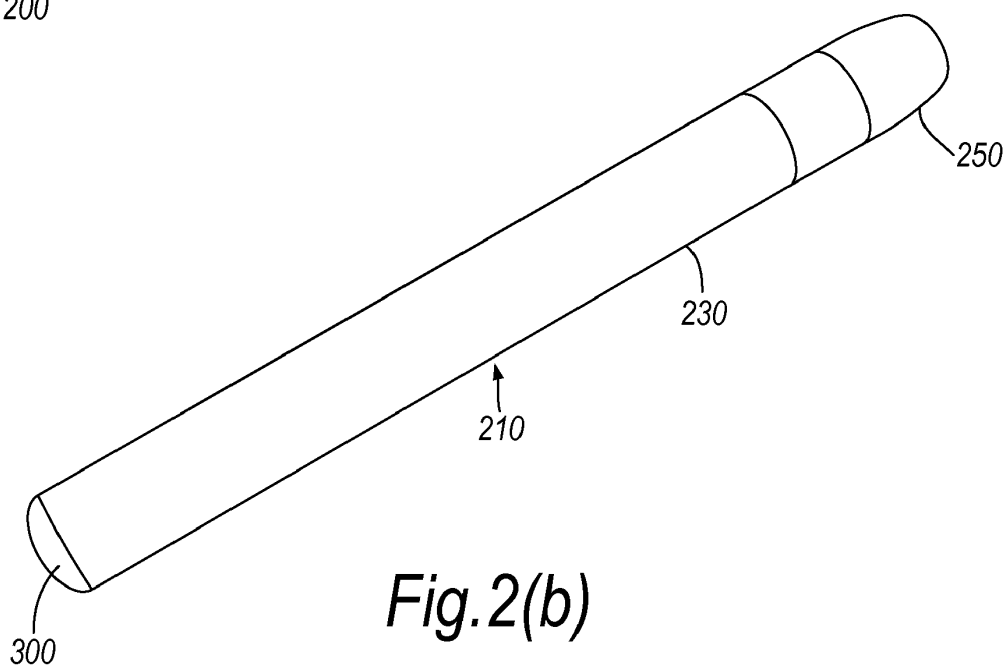
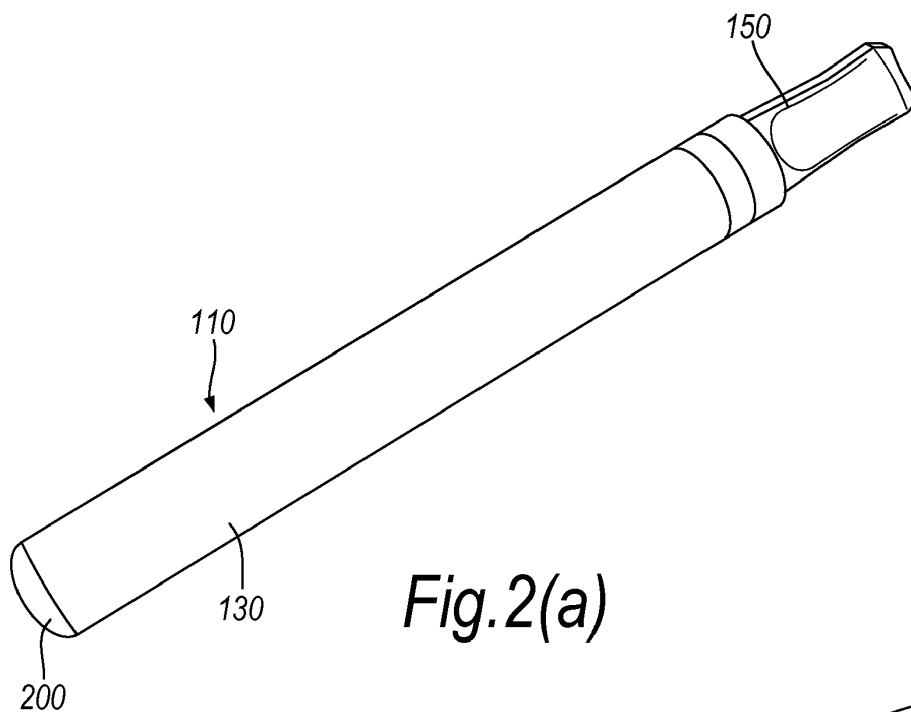
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**MERCHANT & GOULD PC****P.O. BOX 2903****MINNEAPOLIS, MN 55402-0903 (US)**(57) **ABSTRACT**

An electronic smoking-substitute device **110** includes a tube containing a reservoir **310** containing a liquid. The liquid includes a substance to be inhaled by the user, for example a nicotine dilution. The device also has a heating element **320**, the heating element is a coil and is in direct contact with the reservoir **310**. A power source **340** is arranged to power the heating element.

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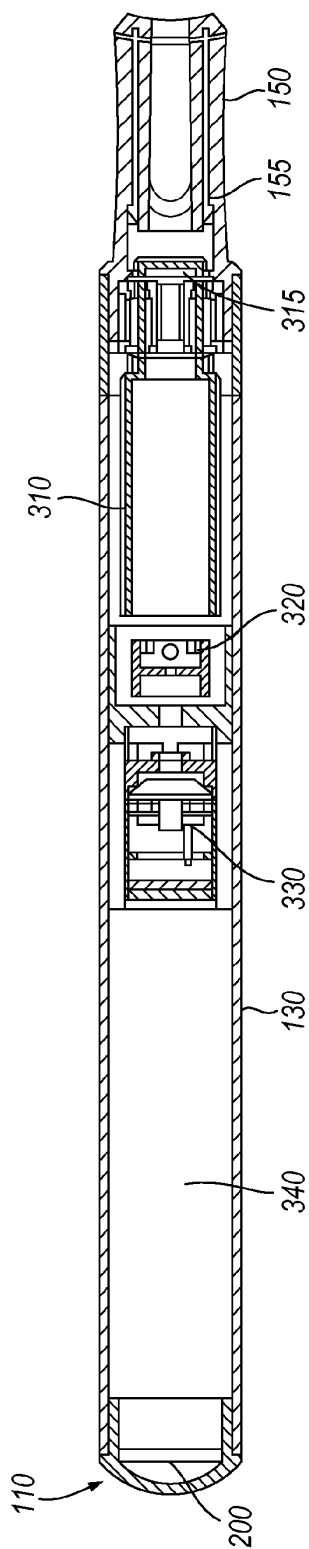


Fig. 3

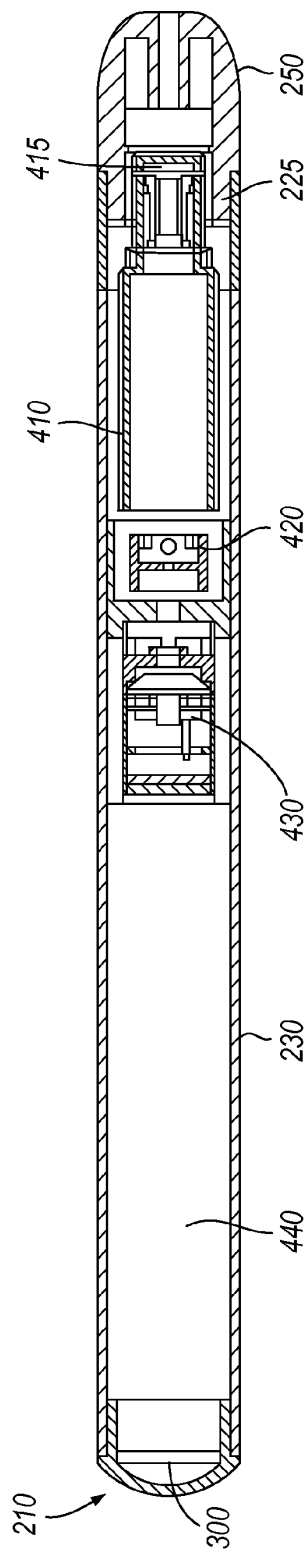


Fig. 4

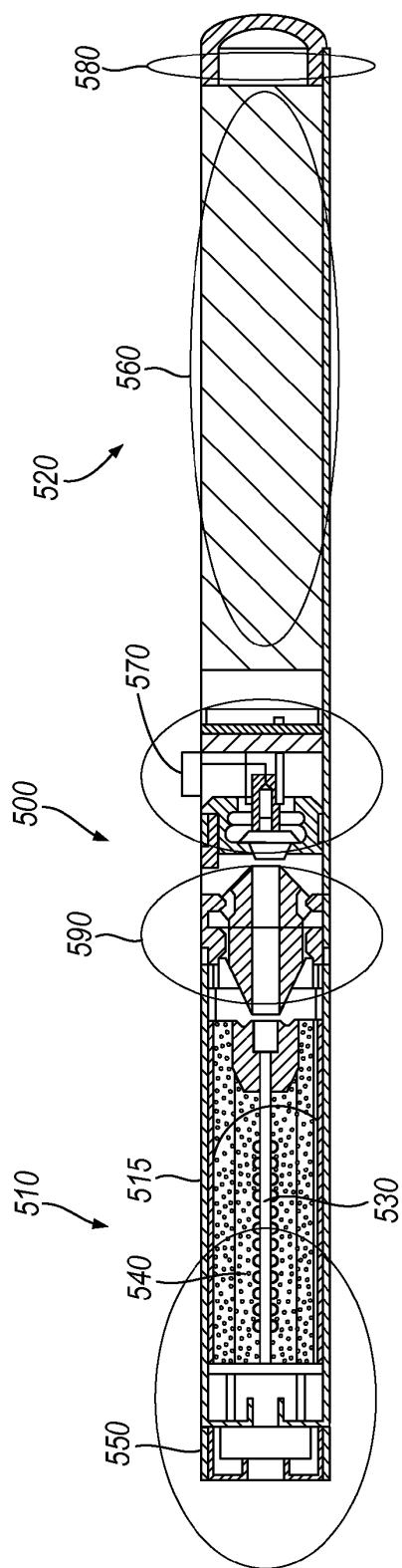


Fig.5

## METHOD AND APPARATUS RELATING TO ELECTRONIC SMOKING-SUBSTITUTE DEVICES

### FIELD OF THE INVENTION

[0001] This invention relates to electronic smoking-substitute devices. More particularly, although not exclusively, the present invention relates to electronic cigarettes and cigars, which provide a user with an inhalable vapour comprising nicotine or another substance, but which do not produce a flame or smoke.

### PRIOR ART

[0002] Conventional smoking devices, including cigarettes, cigars and pipes, are now known to be associated with a variety of problems. They function by burning tobacco, which creates a flame, and which consequently presents a significant fire risk in many environments, including domestic dwellings. Also, substances found in tobacco, for example tar, are believed to be associated with an increased risk of health problems, including life-threatening diseases such as cancer. It is believed that inhalation by third-parties of smoke generated by smokers in closed environments also increases the risk of the third-parties developing such conditions. The experience of others' smoke can also be unpleasant for third-parties, especially in restaurants and the like.

[0003] For those and other reasons, many organisations around the world have banned smoking on their properties. In recent years, some governments have introduced legislation banning smoking in certain environments, for example in enclosed public spaces.

[0004] However, many smokers enjoy regular smoking, and may experience unpleasant psychological or even physiological symptoms if they are unable to smoke frequently.

[0005] To address that issue, smoking-substitute devices have been developed, which enable the user to experience some of the physical and chemical sensations associated with smoking, without actually generating smoke or fire, and which therefore are not affected by the restrictions imposed by statutory and other smoking bans.

[0006] In particular, electronic smoking devices have been developed. These devices typically at least approximately resemble a cigarette or cigar, but are in fact battery-powered electronic devices. They typically comprise three operative components, contained within a cigarette- or cigar-shaped tube, and may include a mouthpiece.

[0007] First, there is a replaceable liquid cartridge. This contains the substance that is to be "smoked". An example cartridge contains a mixture of water, propylene glycol, nicotine, and a scent, all contained within a membrane within the cartridge, which is in turn removably installed within the cigarette-shaped tube. The cartridge is replaceable after it is emptied. It may be filled with one or more substances providing any of a number of flavours, including for example tobacco, chocolate, coffee, apple, cherry, or mint.

[0008] Second, there is a cylindrical heating element, arranged in thermal contact with the cartridge. In use, the heating element heats the cartridge, and thereby atomises the contents of the cartridge. The user of the device sucks on the tube or mouthpiece, activating a switch which switches on the cylindrical heating element, generating the atomised substances, which are then inhaled by the user. The user thus experiences the physical sensation of smoking—and the

chemical consequences as well, where the atomised substances comprise nicotine or other narcotics—but without generating smoke or tar, or even using tobacco (which is subject to high taxation in some countries).

[0009] Some prior-art devices include a safety cut-off, which switches the device off after a set number of inhalations to prevent the potentially toxic effect of excessive inhalation of nicotine or the like.

[0010] Third, the electronic smoking device includes a rechargeable battery, to power the cylindrical heating element. The rechargeable battery is in electrical contact with the cylindrical heating element. Before using the device for the first time, the user charges the battery, which then typically provides sufficient power for about 1½ hours of use or about 300 inhalations before recharging is required.

[0011] To enable repeated use for multiple charges, prior-art electronic smoking devices are designed to be durable, typically being made out of metal. That results in the devices being relatively heavy. The batteries used in prior-devices are relatively low-power, and the device design results in inefficient transfer of heat, which means that vapour is produced slowly, and hence in smaller quantities than may be desirable. Furthermore, frequent charging is required.

[0012] The present invention seeks to ameliorate at least one of the abovementioned problems.

### SUMMARY OF THE INVENTION

[0013] In a first aspect, the invention provides an electronic smoking-substitute device comprising a tube containing:

[0014] a reservoir containing a liquid, the liquid comprising a substance to be inhaled by the user;

[0015] a heating element, the heating element being a coil and being in direct contact with the reservoir; and

[0016] a power source, arranged to power the heating element.

[0017] The device is preferably arranged so that the reservoir is not removable; for example, it may be that it is not possible to remove the reservoir from the tube without dismantling other parts of the device or damaging or destroying the device. In an alternative embodiment of the invention, the device may be made of two main parts. The two main parts may screw together. The two main parts may be joined together such that it is not possible to separate them without damaging or destroying the device.

[0018] The liquid may be a mixture of a flavouring substance and water, nicotine, propylene glycol, and a scent. The mixture may be contained within a membrane.

[0019] The flavouring substance may be any of tobacco, chocolate, coffee, apple, cherry, or mint.

[0020] The inventor has found that the heating coil heats more effectively than prior-art cylindrical heating elements. Preferably, the heating coil requires less power to get to the required temperature to vaporise the liquid than a cylindrical heating element.

[0021] Advantageously, this means that a smaller battery can be used in the device, and/or the battery is capable of powering more inhalations than a battery used in conjunction with a prior-art cylindrical heating element. Preferably, the liquid is heated to a higher temperature than in prior-art devices; that results in a more powerful atomising effect, and a greater rate of vapour generation for inhalation. We believe that the more effective heating results because the coil has a larger effective area than a cylinder of the same size. The coil may be helical. We believe that the more effective heating also

results because the coil is in direct contact with the reservoir, whereas, in prior-art devices, provision of a replaceable liquid cartridge results in the cylindrical heating element being separated from the liquid to be atomised by a greater thermal path length.

[0022] The device may include a mouthpiece through which the atomised liquid can be inhaled.

[0023] The device may include a switch arranged to activate the heating element when the user sucks on the tube, or mouthpiece if present. In an alternative embodiment, the device may include an external switch arranged to activate the heating element. The external switch may be a push or slide switch. An external switch according to an embodiment of the invention may be more robust and/or reliable than a switch arranged to activate the heating element when the user sucks on the tube.

[0024] The device may include a safety cut-off, which switches the device off after a set number of inhalations.

[0025] The device is arranged so that the power source is not rechargeable; for example, it may be that there is no electrical connection from the power source to the outside of the device; it may be that it is not possible to remove the power source from the tube without dismantling other parts of the device or damaging or destroying the device. The power source may be a cell. The power source may be a battery. Preferably, the power source is not a rechargeable battery.

[0026] In contrast with prior-art devices, there is no need to charge a rechargeable battery before using the device; rather, the device is preferably immediately useable, as it preferably contains an initially fully charged power source. Similarly, there is no need, or indeed opportunity, to recharge the device.

[0027] The power source may be connected directly to the heating element.

[0028] Preferably, the power source stores sufficient energy to enable at least 600 inhalations of atomised liquid. In an alternative embodiment the power source stores sufficient energy to enable approximately 375 inhalations, which is equivalent to 25 normal (tobacco) cigarettes.

[0029] Preferably, the tube is a plastics material. Using a plastics material has advantages over the prior-art use of metal, because plastics materials typically act as thermal insulators, which improves the thermal efficiency of the device, and hence improves the atomisation provided by unit power from the power source. Plastic is also generally cheaper than metal, and it is also lighter. Preferably, the tube is made from a plastics material with a thickness in the range from 1 mm to 2 mm. Preferably, the plastics material is 1.5 mm thick. The plastics material is strong enough to be handled every day and also thick enough to act as an insulator of the heat generated by the heating coil.

[0030] Advantageously, the tube, reservoir, heating element and power source form a single unit. That is in contrast to the prior art, which is modular in design, with a removable cartridge and rechargeable battery. Preferably, the tube, reservoir, heating element and power source cannot be dismantled from each other without destroying the device.

[0031] Providing a one-piece, non-modular design offers advantages over the prior art. Because the device is not designed for long-term use, it can be made of materials that are less-durable, and hence cheaper, than those of prior-art devices. The device is disposable; that is, it is intended to be disposed of without recharging the power source or refilling the reservoir, which indeed is preferably not possible. The

device is made from materials that are sufficiently cheap for disposal, without recharging or refilling, to be economically viable.

[0032] A further advantage of the one-piece, disposable design is that the device is lighter than prior art devices, which are designed to be more durable. An embodiment of the invention may be sized such that it may be packaged in a normal cigarette box.

[0033] In an alternative embodiment, the reservoir and heating element form a first part and the battery forms a second part. The reservoir and heating element in the first part may be directly integrated such that the heating element is located within the reservoir. It is believed that such a design improves the smoking experience of the user by providing a more intense and/or fresh supply of vapour. Additionally, the integration of the reservoir and the heating element in the first part may be such that the user cannot access the nicotine dilution, other than by activating the heating element. Such a feature may make the device more hygienic to use. The first and second parts may be arranged to be screwed together for easy construction of the device. Alternatively, the first and second parts may be arranged to be connected by a push fit design. Once the first and second parts have been joined together, they may be arranged such that it is not possible to dismantle the device without damaging or destroying the device. Advantageously, the reservoir and heating element are inaccessible to a user. This may reduce the potential for the device to leak.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Certain illustrative embodiments of the invention will now be described in detail, by way of example only, with reference to the accompanying schematic drawings, in which:

[0035] FIG. 1 is a prior-art electronic cigarette;

[0036] FIG. 2 is (a) an electronic cigarette according to a first example embodiment of the invention, and (b) an electronic cigar according to a second example embodiment of the invention;

[0037] FIG. 3 is a longitudinal cross-section through the electronic cigarette of FIG. 2(a);

[0038] FIG. 4 is a longitudinal cross-section through the electronic cigar of FIG. 2(b); and

[0039] FIG. 5 is a longitudinal cross-section through an electronic cigarette according to a third example embodiment of the invention.

#### DETAILED DESCRIPTION

[0040] A prior-art electronic cigarette 10 comprises three tubular components: a mouthpiece portion 20, a cartridge portion 30, and a rechargeable power portion 40.

[0041] The mouthpiece portion 20 is tubular and comprises a mouthpiece 50, which is a flattened tube for easy gripping between the user's lips, and an attachment portion 60, which is shaped to fit inside a first end 70 (proximal to the user's lips) of the cartridge portion 30.

[0042] The cartridge portion 30 is tubular and of circular cross-section, and includes said first, proximal, end 70, and a second, distal, end 80. The distal end 80 includes an internal screw thread. The cartridge portion 30 contains a reservoir (not shown) of the liquid that is to be inhaled, and a heating cylinder (not shown) for atomising the liquid.

[0043] The rechargeable power portion 40 is tubular and of circular cross-section, and includes a first, proximal end 90,

and, at its second, distal, end, an LED within a protective plastic shell 100. The proximal end 90 of the rechargeable power portion 40 includes an external screw-thread, which engages with the internal screw thread of the distal end 80 of the cartridge portion 30. The power portion 40 contains a rechargeable battery (not shown), which has terminal contacts (not shown) near the proximal end 90, by which the battery can be re-charged. The power portion 40 also contains a switch (not shown), which is connected between the rechargeable battery and (when device 10 is assembled) to the heating cylinder. The LED within the shell 100 is connected to the switch and to the rechargeable battery such that when current is drawn from the battery to power the heating element, the LED lights up.

[0044] Thus the cigarette 10 is assembled by sliding the attachment portion 60 of the mouthpiece portion 20 into the first, proximal, end 70 of the cartridge portion 30, and screwing the second, distal, end 80 of the cartridge portion 30 into the first, proximal end 90 of the rechargeable power portion 40.

[0045] In use, the user sucks on the mouthpiece 50, which activates the switch, turning on the heating cylinder, which atomises the liquid, which the user then inhales. The device 10 is dis-assembled for charging of the rechargeable power portion 40, and for refill of the reservoir or replacement of the cartridge portion 30.

[0046] A first example embodiment of the invention—an electronic cigarette 110—is shown in FIG. 2(a), and a second example embodiment of the invention—an electronic cigar 210—is shown in FIG. 2(b). In both cases, it will be apparent that the devices are substantially one-piece devices, comprising a tubular body 130, 230, a mouthpiece 150, 250, and an LED end 200, 300. It will be apparent that the one-piece nature of the devices 110, 210 eliminates the joins present along the length of prior-art cigarette 10, resulting in devices 110, 210 having a superior aesthetic appearance, and more closely resembling a conventional cigarette and cigar, respectively.

[0047] The internal construction of devices 110, 210 is shown in the cross-sections of FIGS. 3 and 4. It will be seen that the cigarette 110 and cigar 210 are very similar in internal construction, differing only slightly in their dimensions, save at their mouthpieces 150, 250.

[0048] The mouthpiece 150 of the cigarette 110 is a flattened tube for easy gripping between the user's lips. It is moulded together with a distal tubular portion 155 of substantially circular cross-section, which fits, and is permanently attached, inside the end of the tube 130 that is proximal to the user's lips in use.

[0049] The mouthpiece 250 of the cigar 210 is a tube of frustoconical shape—of substantially circular cross-section, tapering slightly to a blunt end. Again, its distal end 255 fits, and is permanently attached, inside the end of the tube 230 that is proximal to the user's lips in use.

[0050] The remaining parts of the devices 110, 210 found within the tubes 130, 230 will now be described together, for convenience.

[0051] Immediately adjacent to the mouthpiece 150, 250 within the tube 130, 230 is a reservoir 310, 410 containing a nicotine dilution. A membrane 315, 415 separates the interior of the reservoir 310, 410 from the interior of the tubular mouthpiece 150, 250. The membrane prevents passage of the nicotine from the reservoir 310, 410 to the mouthpiece 150, 250 prior to atomisation of the dilution.

[0052] Next along the length of the tube 130, 230, immediately adjacent to the reservoir 310, 410, is an atomiser in the form of a heating element 320, 420. The atomiser is in the form of a coil.

[0053] Next along the length of the tube 130, 230, immediately adjacent to the heating element 320, 420, is a switch 330, 430. The switch 330, 430 is in electrical connection with the heating element 320, 420. The switch 330, 430 is activated (switching on the heating element 320, 420) by airflow caused by the user sucking on the mouthpiece 150, 250.

[0054] Next along the length of the tube 130, 230, immediately adjacent to the switch 330, 430 is a power source in the form of a 3.7 V Li-ion battery 340, 440. The power source 340, 440 is in electrical connection with the switch 330, 430 and the heating element 320, 420, and powers the heating element 320, 420, when the switch 330, 430 is activated.

[0055] Finally, at the distal end of the tube 130, 230, is a red LED 200, 300, which is also in electrical connection with the power source 340, 440, switch 330, 430, and heating element 320, 420. The LED 200, 300 is switched on simultaneously with the heating element 320, 420 when the switch 330, 430 is activated.

[0056] In use, the user of the cigarette 110 or cigar 210 sucks on the mouthpiece 150, 250, which activates the switch 330, 430, drawing current from the power source 340, 440 to power the heating element 320, 420. The heating element 320, 420 heats the nicotine dilution in the reservoir 310, 320, causing the nicotine dilution to atomise and be drawn by the user's sucking action through the membrane 315, 415 and the mouthpiece 150, 250 into the user's mouth.

[0057] Note that none of the reservoir 310, 410, the heating element 320, 420, the switch 330, 430 or the battery 340, 440 can be removed from the tube 130, 230 without damaging or destroying the tube 130, 230. Rather, the components of the cigarette 110 and cigar 210 form a one-piece entity, which the user uses until the reservoir 310, 410 is empty or the power source 340, 440 is drained, and then throws away, without attempting to replace or refill the reservoir 310, 410, or to replace or recharge the power source 340, 440.

[0058] FIG. 5 shows a third example embodiment of the invention. An electronic cigarette is made up of a tube 500 comprising a first part 510 and a second part 520. The first part 510 and second part 520 are screwed together such that they form the tube 500, the external surfaces of the tube 500 being flush, with no join being noticeable by a user. The location of the screw fixing is shown as 590 on FIG. 5. The first part 510 includes an integrated cartridge and vaporization chamber 515. The integrated cartridge and vaporization chamber 515 includes a coiled heating element 530 and a sponge 540, the sponge being 540 impregnated with a nicotine dilution. The sponge 540 is surrounded by a membrane to prevent the passage of the nicotine dilution from the sponge 540 prior to the dilution being atomised by the heating element 530. The first part 510 also includes a mouth piece 540 arranged to be sucked by a user in order to inhale the nicotine dilution that is atomised by the heating element 530 in the integrated cartridge and vaporization chamber 515. The second part 520 includes a power source 560 arranged to be in electrical contact with the heating element 530 when the first part 510 and second part 520 are joined. The second part 520 also includes a push switch 570 arranged to control the power source 560. When the push switch 570 is activated by a user, the power source 560 supplies the heating element 530 with power. The heating element 530 atomises some of the nico-

tine dilution contained in the sponge **540** which can then pass through the membrane and be inhaled by the user. The second part **520** also includes an LED **580** located at the distal end of the second part **520** which is activated by operation of the push switch **570** in order to show that the electronic cigarette **500** is operating. The LED may be a green LED in order to reduce potential confusion with a normal cigarette.

[0059] The screw connection between the first part **510** and second part **520** enables easy construction of the electronic cigarette **500**. The screw connection between the two parts may include a catch mechanism to prevent the two parts being unscrewed from each other. In an alternative embodiment, the connection between the two parts may be a push fit. The push fit may include a catch arranged to prevent the two structural elements from being pulled apart.

[0060] Whilst the present invention has been described and illustrated with reference to particular example embodiments, it will be appreciated by those of ordinary skill in the art that the invention lends itself to many different variations not specifically illustrated herein. Some examples of such variations and alternatives have been described above. Furthermore, those of ordinary skill in the art will appreciate that features as described for one example embodiment of the invention may be applicable to another example embodiment of the invention, and vice versa.

[0061] Where in the foregoing description, integers or elements are mentioned which have known, obvious or foreseeable equivalents, then such equivalents are herein incorporated as if individually set forth. Reference should be made to the claims for determining the true scope of the present invention, which should be construed so as to encompass any such equivalents. It will also be appreciated by the reader that integers or features of the invention that are described as preferable, advantageous, convenient or the like are optional and do not limit the scope of the independent claims.

1. An electronic smoking-substitute device comprising a tube containing:

- a reservoir containing a liquid, the liquid comprising a substance to be inhaled by the user;
- a heating element, the heating element being a coil and being in direct contact with the reservoir; and
- a power source, arranged to power the heating element.

2. A device as claimed in claim 1, in which the reservoir is not removable from the tube without dismantling other parts of the device or destroying the device.

3. A device as claimed in claim 1, in which the power source is not rechargeable.

4. A device as claimed in claim 1, in which the power source is connected directly to the heating element.

5. A device as claimed in claim 1, in which the power source is sufficient to enable at least 600 inhalations of atomised liquid.

6. A device as claimed in claim 1, in which the tube is a plastics material.

7. A device as claimed in claim 1, in which the tube, reservoir, heating element and power source form a single unit.

8. A device as claimed in claim 1, in which the reservoir and the heating element form a first part and the power supply forms a second part.

9. A device as claimed in claim 1, further comprising a switch for activation of the heating element.

10. A device as claimed in claim 9, wherein the switch is a push switch located on the external surface of the tube.

11. A device as claimed in claim 9, wherein the switch is an internal switch activated by a user sucking on the device.

12. A device as claimed in claim 1, wherein the heating element is directly integrated with the reservoir.

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