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(54) **ELECTRONIC SMOKING DEVICE, CARTOMIZER AND LIQUID RESERVOIR**

(57) There is provided a liquid reservoir for an electronic smoking device. The liquid reservoir (34) has a body (110) forming a hollow tube surrounding a central passage (32) connecting an air inhalation port (36) with a further port for attaching the liquid reservoir (34) to a further portion of the electronic cigarette (10). The liquid reservoir (34) further has a nozzle (132) towards the cen-

tral passage (32), the nozzle (32) being configured to release liquid from the reservoir (34) only when pressure drop along the nozzle (32) exceeds a threshold pressure. A user can produce the pressure drop by sucking at the air inhalation port (36) and/or by manually changing a length of the central passage (32) thereby causing compression of the liquid reservoir (34).

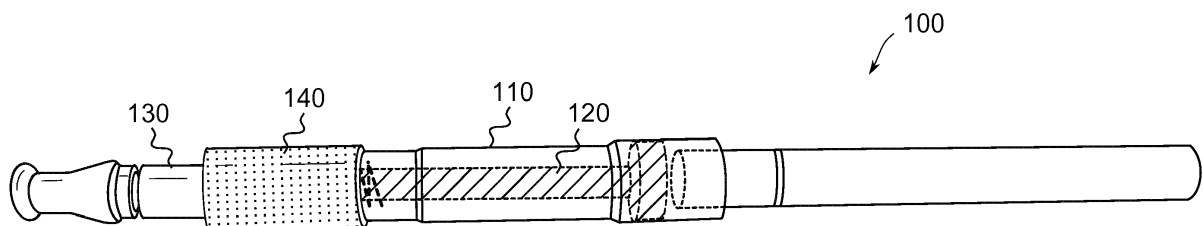


Fig. 2

**Description**FIELD OF INVENTION

**[0001]** The present invention relates generally to electronic smoking devices and in particular electronic cigarettes as well as cartomizers and liquid reservoirs for electronic smoking devices.

BACKGROUND OF THE INVENTION

**[0002]** An electronic smoking device, such as an electronic cigarette (e-cigarette), typically has a housing accommodating an electric power source (e.g. a single use or rechargeable battery, electrical plug, or other power source), and an electrically operable atomizer. The atomizer vaporizes or atomizes liquid supplied from a reservoir and provides vaporized or atomized liquid as an aerosol. Control electronics control the activation of the atomizer. In some electronic cigarettes, an airflow sensor is provided within the electronic smoking device which detects a user puffing on the device (e.g., by sensing an under-pressure or an air flow pattern through the device). The airflow sensor indicates or signals the puff to the control electronics to power up the device and generate vapor. In other e-cigarettes, a switch is used to power up the e-cigarette to generate a puff of vapor.

**[0003]** Some electronic smoking devices comprise a cartomizer which is a replaceable unit comprising the atomizer and the reservoir for the liquid.

SUMMARY OF THE INVENTION

**[0004]** In accordance with one aspect of the present invention there is provided a liquid reservoir for an electronic smoking device. The liquid reservoir comprises a body forming a hollow tube surrounding a central passage connecting ports for attaching the liquid reservoir to further portions of the electronic cigarette. The liquid reservoir further comprises a nozzle towards the central passage, the nozzle being configured to release liquid from the liquid reservoir only when pressure drop along the nozzle exceeds a threshold pressure. A user can produce the pressure drop by sucking at an inhalation port of the electronic smoking device and/or by manually changing a length of the central passage thereby causing compression of the liquid reservoir.

**[0005]** The characteristics, features and advantages of this invention and the manner in which they are obtained as described above, will become more apparent and be more clearly understood in connection with the following description of exemplary embodiments, which are explained with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** In the drawings, same element numbers indicate same elements in each of the views:

- Figure 1 is a schematic cross-sectional illustration of an exemplary e-cigarette;
- Figure 2 is an exemplary illustration of a liquid reservoir according to an aspect of the invention;
- Figure 3 is an exemplary illustration of the liquid reservoir of figure 2 partly disassembled;
- Figure 4 is a schematic cross-sectional illustration of figure 2 when the liquid reservoir is uncompressed;
- Figure 5 is a schematic cross-sectional illustration of figure 2 when the liquid reservoir is compressed;
- Figure 6 is a schematic cross-sectional illustration of a further liquid reservoir according to an aspect of the invention;
- Figure 7 is a schematic cross-sectional illustration of a yet further liquid reservoir according to an aspect of the invention, and
- Figure 8 is a schematic cross-sectional illustration of an even yet further liquid reservoir according to an aspect of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0007]** Throughout the following, an electronic smoking device will be exemplarily described with reference to an e-cigarette. As is shown in Figure 1, an e-cigarette 10 typically has a housing comprising a cylindrical hollow tube having an end cap 16. The cylindrical hollow tube may be single piece or a multiple piece tube. In Figure 1, the cylindrical hollow tube is shown as a two piece structure having a battery portion 12 and an atomizer/liquid reservoir portion 14. Together the battery portion 12 and the atomizer/liquid reservoir portion 14 form a cylindrical tube which is approximately the same size and shape as a conventional cigarette, typically about 100 mm with a 7.5 mm diameter, although lengths may range from 70 to 150 or 180 mm, and diameters from 5 to 20 mm.

**[0008]** The battery portion 12 and atomizer/liquid reservoir portion 14 are typically made of steel or hardwearing plastic

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

**[0009]** An air inlet may be provided in the end cap, at the edge of the inlet next to the cylindrical hollow tube, anywhere along the length of the cylindrical hollow tube, or at the connection of the battery portion 12 and the atomizer/liquid reservoir portion 14. Figure 1 shows a pair of air inlets 38 provided at the intersection between the battery portion 12 and the atomizer/liquid reservoir portion 14.

**[0010]** A battery 18, a light emitting diode (LED) 20, control electronics 22 and optionally an airflow sensor 24 are provided within the cylindrical hollow tube battery portion 12. The battery 18 is electrically connected to the control electronics 22, which are electrically connected to the LED 20 and the airflow sensor 24. In this example the LED 20 is at the front end of the battery portion 12, adjacent to the end cap 16 and the control electronics 22 and airflow sensor 24 are provided in the central cavity at the other end of the battery 18 adjacent the atomizer/liquid reservoir portion 14.

**[0011]** The airflow sensor 24 acts as a puff detector, detecting a user puffing or sucking on the atomizer/liquid reservoir portion 14 of the e-cigarette 10. The airflow sensor 24 can be any suitable sensor for detecting changes in airflow or air pressure such a microphone switch including a deformable membrane which is caused to move by variations in air pressure. Alternatively the sensor may be a Hall element or an electro-mechanical sensor.

**[0012]** The control electronics 22 are also connected to an atomizer 26. In the example shown, the atomizer 26 includes a heating coil 28 which is wrapped around a wick 30 extending across a central passage 32 of the atomizer/liquid reservoir portion 14. The coil 28 may be positioned anywhere in the atomizer 26 and may be transverse or parallel to the liquid reservoir 34. The wick 30 and heating coil 28 do not completely block the central passage 32. Rather an air gap is provided on either side of the heating coil 28 enabling air to flow past the heating coil 28 and the wick 30. The atomizer may alternatively use other forms of heating elements, such as ceramic heaters, or fiber or mesh material heaters. Nonresistance heating elements such as sonic, piezo and jet spray may also be used in the atomizer in place of the heating coil.

**[0013]** The central passage 32 is surrounded by a cylindrical liquid reservoir 34 with the ends of the wick 30 abutting or extending into the liquid reservoir 34. The wick 30 may be a porous material such as a bundle of fiberglass fibers, with liquid in the liquid reservoir 34 drawn by capillary action from the ends of the wick 30 towards the central portion of the wick 30 encircled by the heating coil 28.

**[0014]** The liquid reservoir 34 may alternatively include wadding soaked in liquid which encircles the central passage 32 with the ends of the wick 30 abutting the wadding. In other embodiments the liquid reservoir 34 may comprise a toroidal cavity arranged to be filled with liquid and with the ends of the wick 30 extending into the toroidal cavity.

**[0015]** An air inhalation port 36 is provided at the back end of the atomizer/liquid reservoir portion 14 remote from the end cap 16. The inhalation port 36 may be formed from the cylindrical hollow tube atomizer/liquid reservoir portion 14 or maybe formed in an end cap.

**[0016]** In use, a user sucks on the e-cigarette 10. This causes air to be drawn into the e-cigarette 10 via one or more air inlets, such as air inlets 38 and to be drawn through the central passage 32 towards the air inhalation port 36. The change in air pressure which arises is detected by the airflow sensor 24 which generates an electrical signal that is passed to the control electronics 22. In response to the signal, the control electronics 22 activate the heating coil 28 which causes liquid present in the wick 30 to be vaporized creating an aerosol (which may comprise gaseous and liquid components) within the central passage 32. As the user continues to suck on the e-cigarette 10, this aerosol is drawn through the central passage 32 and inhaled by the user. At the same time the control electronics 22 also activate the LED 20 causing the LED 20 to light up which is visible via the translucent end cap 16 mimicking the appearance of a glowing ember at the end of a conventional cigarette. As liquid present in the wick 30 is converted into an aerosol more liquid is drawn into the wick 30 from the liquid reservoir 34 by capillary action and thus is available to be converted into an aerosol through subsequent activation of the heating coil 28.

**[0017]** Some e-cigarette are intended to be disposable and the electric power in the battery 18 is intended to be sufficient to vaporize the liquid contained within the liquid reservoir 34 after which the e-cigarette 10 is thrown away. In other embodiments the battery 18 is rechargeable and the liquid reservoir 34 is refillable. In the cases where the liquid reservoir 34 is a toroidal cavity, this may be achieved by refilling the liquid reservoir 34 via a refill port. In other embodiments the atomizer/liquid reservoir portion 14 of the e-cigarette 10 is detachable from the battery portion 12 and a new atomizer/liquid reservoir portion 14 can be fitted with a new liquid reservoir 34 thereby replenishing the supply of liquid. In some cases, replacing the liquid reservoir 34 may involve replacement of the heating coil 28 and the wick 30 along with the replacement of the liquid reservoir 34. A replaceable unit comprising the atomizer 26 and the liquid reservoir 34 is called a cartomizer.

**[0018]** The new liquid reservoir 34 may be in the form of a cartridge having a central passage 32 through which a user

inhales aerosol. In other embodiments, aerosol may flow around the exterior of the cartridge 32 to an air inhalation port 36.

**[0019]** Of course, in addition to the above description of the structure and function of a typical e-cigarette 10, variations also exist. For example, the LED 20 may be omitted. The airflow sensor 24 may be placed adjacent the end cap 16 rather than in the middle of the e-cigarette. The airflow sensor 24 may be replaced with a switch which enables a user

to activate the e-cigarette manually rather than in response to the detection of a change in air flow or air pressure.  
**[0020]** Different types of atomizers may be used. Thus for example, the atomizer may have a heating coil in a cavity in the interior of a porous body soaked in liquid. In this design aerosol is generated by evaporating the liquid within the porous body either by activation of the coil heating the porous body or alternatively by the heated air passing over or through the porous body. Alternatively the atomizer may use a piezoelectric atomizer to create an aerosol either in combination or in the absence of a heater.

**[0021]** Figure 2 is a schematic illustration of a liquid reservoir according to an aspect of the invention and in figure 3 the liquid reservoir of figure 2 is illustrated schematically in a partly disassembled state. Figure 4 is a schematic cross-sectional illustration of figure 2 when the liquid reservoir is uncompressed and Figure 5 is a schematic cross-sectional illustration of figure 2 when the liquid reservoir is compressed.

**[0022]** The liquid reservoir 34 comprises a body in form of a hollow cylinder 110 into which a tubal element 120 is inserted. The tubal element 120 has an annularly protruding ring 121 on one end. The ring's 121 outer diameter corresponds to the hollow cylinder's 110 inner diameter such that the hollow cylinder 110 can be closed at one end by insertion of the tubal element 120 into the hollow cylinder 110 with a toroidal cavity remaining between the tubal element 120 and the cylinder 110.

**[0023]** Through the ring 121 there is a pin hole 123. Cylinder 110, ring 121 and pin hole 123 are configured such that once assembled the cavity is water proof as long as pressure drop along the pin hole 123 does not exceed a threshold pressure. I.e. to get liquid to escape from the cavity, through the pin hole 123, pressure has to be build up in the cavity.

**[0024]** For enabling a user to manually do so, the cartomizer depicted in figures 2 and 3 further comprises a hollow piston 130. The piston 130 is a further tubal element with an outer diameter corresponding to the inner diameter of the hollow cylinder 110 and, in addition, an inner diameter of the hollow piston 130 corresponds to an outer diameter of the tubal element 120 such that the hollow cylinder 110 can be closed at the other end by insertion of the piston 130 into the hollow cylinder 110 and onto the tubal element 120. At an end of the piston 130 determined for insertion into the cylinder there are an inner gasket ring 132 at the inner surface of the tubal piston 130 and an outer gasket ring 131 at the outer surface of the piston 130. The inner gasket ring 132 seals the piston 130 with respect to the tubal element 120. The outer gasket ring 131 seals the piston 130 with respect to the hollow cylinder 110. Alternatively, the inner gasket ring 132 is provided around the tubal element 120 and/or the outer gasket ring 131 is provided inside the hollow cylinder 110. The gasket rings 131, 132 may be positioned in an annular furrow.

**[0025]** The user then can move the piston inside the hollow cylinder thereby changing a volume of the cavity and thus the pressure in the cavity.

**[0026]** A limiting element 140 is further comprised. The limiting element 140 is formed to be hollow and cylindrical and comprises a plate 142 at one end. An axial hole 119 is provided through the plate 142, the axial hole 119 having a diameter corresponding to an outer diameter of the piston 120. The limiting element 140 has an inner diameter corresponding to the outer diameter of the hollow cylinder 110 such that the limiting element 140 can be fit on the hollow cylinder 110. In the embodiment depicted the limiting element 140 comprises a female thread and the hollow cylinder 110 comprises a male thread such that the limiting element 140 and the hollow cylinder 110 can be screwed together.

**[0027]** In a middle section, the piston 130 comprises a thickened part 134, also called annular protrusion throughout this specification, which has an outer diameter larger than the axial hole 119. Hence the thickened part 134 cannot pass through the axial hole 119. The limiting element thereby limits movement of the piston 130.

**[0028]** Between the thickened part 134 of the piston 130 and the other end of the hollow cylinder 110 there is arranged a resilient element which in the example illustrated is a spring 150. The piston passes through the spring. The user, when pushing the piston for reducing the volume of the cavity, compresses the spring which, once the user stops holding the piston, moves the piston back. The limiting element prevents the piston from escaping from the hollow cylinder. Moving the piston into the hollow cylinder increases the pressure therein with liquid squirting through the pin hole once the pressure increase exceeds a threshold pressure. When the spring moves back the piston air enters into the cavity through the pin hole 123.

**[0029]** In one embodiment, a heating coil (atomizer) is an integral part of a battery portion of the electronic smoking device and the liquid reservoir is detachable from the battery portion. In one other embodiment the atomizer is an integral part of the cartomizer and the cartomizer is detachable from the battery portion. In yet another embodiment the atomizer is detachable from both the liquid reservoir and the battery portion. In the other embodiments, the atomizer, respectively the cartomizer, and the battery portion comprise elements for electrically connecting the atomizer, respectively the cartomizer, to a battery comprised in the battery portion when being attached thereto. The elements and the counter-elements can be a pair of female and male coaxial threads, for instance.

**[0030]** In another exemplary embodiment depicted in figure 6, the spring is arranged between the plate 142 of the

limiting element 140 and the thickened part 134 of the piston 130. The user, when pulling the piston 130, increases the volume of the cavity with air entering through the pin hole 123 and compresses the spring 150. Once the user stops holding the piston 130, the spring moves the piston 130 back thereby reducing the volume again and squirting out liquid through the pin hole 123.

**[0031]** Figure 7 is a schematic cross-sectional illustration of a further cartomizer comprising a liquid reservoir according to an embodiment of the invention.

**[0032]** The cartomizer 100 comprises a hollow cylinder 110 having a plate 111 with an axial hole 119 at one end. Through the axial hole 119 and fitting thereto passes a piston 130. The piston 130 has an annularly protruding ring 121 on one end 122. The ring's 121 outer diameter corresponds to the hollow cylinder's 110 inner diameter such that the hollow cylinder 110 can be closed at one end by insertion of the piston 130 into the hollow cylinder 110 with a toroidal cavity remaining between the piston 130 and the cylinder 110. Around the ring there are an outer gasket ring, for instance in an annular furrow. At an inner surface of the axial hole 119 there is an outer gasket ring. The inner gasket ring seals the piston 130 with respect to the plate. The outer gasket ring seals the piston 130 with respect to the hollow cylinder 110. Alternatively, inner gasket ring is provided in the axial hole 119 and/or the outer gasket ring is provided in the hollow cylinder. The gasket rings may be positioned in an annular furrow.

**[0033]** Through the ring 121 there is a pin hole 123. Cylinder, ring, gasket and pin hole are configured such that once assembled the cavity is water proof as long as pressure drop along the pin hole does not exceed a threshold pressure. I.e. to get liquid to escape from the cavity, through the pin hole, pressure has to be build up in the cavity.

**[0034]** For enabling a user to manually do so, the piston 130 can be moved in the hollow cylinder 110.

**[0035]** Using the piston 130, the user then can change volume of the cavity and thus the pressure in the cavity.

**[0036]** A limiting element 140 is further comprised. The limiting element 140 is hollow and cylindrical and comprises a plate 142 at one end. An axial hole 143 is provided through the plate 142, the axial hole 143 having a diameter corresponding to an outer diameter of the piston 130. The limiting element 140 has an inner diameter corresponding to the outer diameter of the hollow cylinder 110 such that the limiting element 140 can be fit on the hollow cylinder 110. In the embodiment depicted the limiting element 140 comprises a female thread and the hollow cylinder 110 comprises a male thread such that the limiting element 140 and the hollow cylinder 110 can be screwed together. Exemplary other ways of fitting comprise press-fit, snap-fit and the like.

**[0037]** In a middle section, the piston 130 comprises a thickened part 134, also called annular protrusion throughout this specification, which has an outer diameter larger than the axial holes 119 and 143. Hence the thickened part 134 cannot pass through the axial holes. The limiting element thereby limits, together with the plate of the hollow cylinder, movement of the piston 130.

**[0038]** Between the thickened part 134 of the piston 130 and the plate 142 of the limiting element 140 there is arranged a resilient element which in the example illustrated is a spring 150. The piston 130 passes through the spring. The user, when pulling the piston 130 for reducing the volume of the cavity, compresses the spring which, once the user stops holding the piston 130, moves the piston 130 back. By pulling the piston 130, volume of the cavity is reduced and pressure inside the remaining cavity is increased with liquid squirting through the pin hole once the pressure increase exceeds a threshold pressure. When the spring moves back the piston 130 air enters into the cavity through the pin hole.

**[0039]** Figure 8 shows another exemplary embodiment of the invention, the spring is arranged between the hollow cylinder and the thickened part 134 of the piston 130. The user, when pushing the piston 130, increases the volume of the cavity with air entering through the pin hole 123 and compresses the spring 150. Once the user stops holding the piston 130, the spring 150 moves the piston 130 back thereby reducing the volume again and squirting out liquid through the pin hole 123.

**[0040]** The hollow cylinder 110 may be made of transparent material. Then the remaining liquid in the liquid reservoir 34 is well visible.

**[0041]** An aspect of the invention concerns a liquid reservoir 34 for an electronic smoking device 10. The liquid reservoir 34 has a body 110 forming a hollow tube surrounding a central passage 32 connecting an air inhalation port 36 with a further port for attaching the liquid reservoir 34 to a further portion of the electronic cigarette 10. The liquid reservoir 34 further has a nozzle 132 towards the central passage 32, the nozzle 32 being configured to release liquid from the reservoir 34 only when pressure drop along the nozzle 32 exceeds a threshold pressure. A user can produce the pressure drop by sucking at an air inhalation port 36 of the electronic smoking device 10 and/or by manually changing a length of the central passage 32 thereby causing compression of the liquid reservoir 34.

**[0042]** The pressure drop can be produced only by the user sucking at the air inhalation port 36. The pressure drop can be produced only by compressing the liquid reservoir 34 such that a pressure in the liquid reservoir 34 is increased at least by the threshold pressure.

**[0043]** The liquid reservoir 34 may comprise a hollow cylindrical body 110 closed on one end with a plate 121 in which the nozzle 123 is arranged and having an open opposite end opposite to the one end. A piston 130 may be inserted through the open end into the hollow cylindrical body 110 for closing the open end. The user may be enabled to move the piston 130 with respect to the hollow cylindrical body 110 for causing compression of the liquid reservoir 34.

**[0044]** The cylindrical body 110 may form a toroidal cavity together with an axial tubal element 120 extending along an axis of the cylindrical body and through the plate 121. The piston 130 may comprise a hollow rod 133 at least partly surrounding the tubal element 120 wherein the hollow rod 133 can be moved along the tubal element 120. The tubal element 120 and the hollow rod 133 may surround the central passage 32, at least partly.

**[0045]** The piston 130 may further comprise at least one inner gasket 132 sealing the hollow rod 133 with respect to the tubal element 120 and at least one outer gasket 131 sealing the hollow rod 133 with respect to the cylindrical body.

**[0046]** The user may be enabled to compress the liquid reservoir 34 from having a first volume to having a smaller second volume.

**[0047]** A resilient element 150 may be present for expanding the compressed liquid reservoir 34 to the first volume once the user stops compressing the liquid reservoir 34. The resilient element 150 may comprise a spring arranged between the open end and an annular protrusion 134 around the hollow rod 133 of the piston 130. A limiting element 140 may be further comprised. The limiting element 140 may be configured to preventing the piston 130 from exiting through the open end.

**[0048]** The user may be enabled to reduce a length of the central passage 12 for compressing the liquid reservoir 34. Another aspect of the invention concerns a cartomizer. The cartomizer comprises a liquid reservoir 34 and an electrically operable atomizer 26 configured for vaporizing or atomizing liquid supplied from the liquid reservoir 34 and for providing vaporized or atomized liquid as an aerosol. The liquid reservoir 34 comprises a body 110 forming a hollow tube surrounding a central passage 32 connecting ports for attaching the liquid reservoir 34 to further portions of the electronic cigarette 10. The liquid reservoir 34 has a nozzle 123 towards the central passage 32. The nozzle 123 is configured to release liquid from the liquid reservoir 34 only when pressure drop along the nozzle 123 exceeds a threshold pressure. A length of the central passage 32 can be changed manually by a user thereby causing compression of the liquid reservoir 34 such that a pressure in the liquid reservoir 34 is increased at least by the threshold pressure.

**[0049]** Yet another aspect of the invention concerns an atomizer/liquid reservoir portion 14 for an electronic smoking device 10. The atomizer/liquid reservoir 14 portion comprises a liquid reservoir 34 and an electrically operable atomizer 26 configured for vaporizing or atomizing liquid supplied from the liquid reservoir 34 and for providing vaporized or atomized liquid as an aerosol. The liquid reservoir 34 comprises a body 110 forming a hollow tube surrounding a central passage 32 connecting ports. The liquid reservoir 34 has a nozzle 123 towards the central passage 32. The nozzle 123 is configured to release liquid from the liquid reservoir 34 only when pressure drop along the nozzle 123 exceeds a threshold pressure. A length of the central passage 32 can be changed manually by a user thereby causing compression of the liquid reservoir 34 such that a pressure in the liquid reservoir 34 is increased at least by the threshold pressure.

**[0050]** Even yet another aspect of the invention concerns an electronic smoking device 10. The electronic smoking device 10 comprises one of: (a) a cartomizer comprising a liquid reservoir 34, (b) an atomizer/liquid reservoir portion 14 comprising a liquid reservoir 34, and (c) a liquid reservoir 34 and an electrically operable atomizer 26 configured for vaporizing or atomizing liquid supplied from the liquid reservoir 34 and for providing vaporized or atomized liquid as an aerosol where the atomizer 26 is operable when connected to a battery 18 of the electronic smoking device 10 to atomize liquid stored in the liquid reservoir 34 as an aerosol. The liquid reservoir 34 comprises a body 110 forming a hollow tube surrounding a central passage 32 connecting ports 36, 38. The liquid reservoir 34 has a nozzle 123 towards the central passage 32. The nozzle 123 is configured to release liquid from the liquid reservoir 34 only when pressure drop along the nozzle 123 exceeds a threshold pressure. A length of the central passage 32 can be changed manually by a user thereby causing compression of the liquid reservoir 34 such that a pressure in the liquid reservoir 34 is increased at least by the threshold pressure.

**[0051]** The electronic smoking device may further comprise a battery portion 12 adapted for accommodation of one or more batteries 18 to which the cartomizer, the atomizer/liquid reservoir portion or the liquid reservoir may be releasably attached.

**[0052]** While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the embodiments disclosed, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

#### LIST OF REFERENCE SIGNS

|    |                                   |     |                  |
|----|-----------------------------------|-----|------------------|
| 10 | electronic smoking device         | 100 | cartomizer       |
| 12 | battery portion                   | 110 | hollow cylinder  |
| 14 | atomizer/liquid reservoir portion | 111 | plate            |
| 16 | end cap                           | 119 | axial hole       |
| 18 | battery                           | 120 | tubal element    |
| 20 | light emitting diode (LED)        | 121 | ring protrusion  |
| 22 | control electronics               | 123 | nozzle, pin hole |
|    |                                   | 130 | piston           |

(continued)

|    |    |                     |     |                                    |
|----|----|---------------------|-----|------------------------------------|
|    | 24 | airflow sensor      | 131 | outer gasket ring                  |
|    | 26 | atomizer            | 132 | inner gasket ring                  |
| 5  | 28 | heating coil        | 133 | hollow rod                         |
|    | 30 | wick                | 134 | thickened part, annular protrusion |
|    | 32 | central passage     | 140 | limiting element                   |
|    | 34 | liquid reservoir    | 142 | plate                              |
| 10 | 36 | air inhalation port | 143 | axial hole                         |
|    | 38 | air inlets          | 150 | resilient element, spring          |

**Claims**

- 15 1. Liquid reservoir (34) for an electronic smoking device (10), the liquid reservoir (34) comprising a body (110) forming a hollow tube surrounding a central passage (32) connecting ports (36, 38) for attaching the liquid reservoir (34) to further portions (12) of the electronic cigarette (10), the liquid reservoir (34) having a nozzle (123) towards the central passage (32), the nozzle (123) being configured to release liquid from the liquid reservoir (34) only when pressure drop along the nozzle (123) exceeds a threshold pressure wherein the pressure drop can be produced by a user sucking at an air inhalation port (36) of the electronic smoking device (10) and/or manually changing a length of the central passage (32) thereby causing compression of the liquid reservoir (34).
- 20 2. Liquid reservoir (34) of claim 1 wherein the pressure drop can be produced only by the user sucking at the inhalation port (36).
- 25 3. The liquid reservoir of claim 1 or 2 wherein the liquid reservoir (34) comprises a hollow cylindrical body (110) closed on one end with a plate (121) in which the nozzle (123) is arranged and having an open opposite end arranged opposite to the one end wherein the piston (130) is inserted through the open end into the hollow cylindrical body (110) for closing the open end and wherein the user can move the piston (130) with respect to the hollow cylindrical body (110) for causing compression of the liquid reservoir (34).
- 30 4. The liquid reservoir of claim 3 wherein the cylindrical body (110) forms a toroidal cavity together with an axial tubal element (120) extending along an axis of the cylindrical body (110) and through the plate (121) and wherein the piston (130) comprises a hollow rod (133) at least partly surrounding the tubal element (120) wherein the hollow rod (133) can be moved along the tubal element (120).
- 35 5. The liquid reservoir of claim 4 wherein the tubal element (120) and the hollow rod (133) at least partly surround the central passage (32).
- 40 6. The liquid reservoir of claim 4 or 5 wherein the piston (130) further comprises at least one inner gasket ring (132) sealing the hollow rod (133) with respect to the tubal element (120) and at least one outer gasket ring (131) sealing the hollow rod (133) with respect to the cylindrical body (110).
- 45 7. The liquid reservoir of any of the preceding claims wherein the user can compress the liquid reservoir (34) from having a first volume to having a smaller second volume.
8. The liquid reservoir of claim 7 further comprising a resilient element (150) for expanding the compressed liquid reservoir (34) to the first volume once the user stops compressing the liquid reservoir (34).
- 50 9. The liquid reservoir of any of claims 3 - 6 and of claim 8 wherein the resilient element (150) comprises a spring arranged between the open end and an annular protrusion (134) around the hollow rod (133) of the piston (130).
10. The liquid reservoir of claim 9 further comprising a limiting element (140) configured to prevent the piston (130) from exiting through the open end.
- 55 11. The liquid reservoir of any of the preceding claims wherein the length of the central passage (32) can be reduced by the user for compressing the liquid reservoir (34).

12. Cartomizer for an electronic smoking device, the cartomizer comprising a liquid reservoir (34) of any of the preceding claims and an electrically operable atomizer (26) configured for vaporizing or atomizing liquid supplied from the liquid reservoir (34) and for providing vaporized or atomized liquid as an aerosol.

13. Atomizer/liquid reservoir portion (14) for an electronic smoking device, the atomizer/liquid reservoir portion (14) comprising a liquid reservoir (34) of any of claims 1-11 and an electrically operable atomizer (26) configured for vaporizing or atomizing liquid supplied from the liquid reservoir (34) and for providing vaporized or atomized liquid as an aerosol.

14. Electronic smoking device (10) comprising one of:

- a. a cartomizer according to claim 12,
- b. an atomizer/liquid reservoir portion (14) according to claim 13, and
- c. a liquid reservoir (34) of any of claims 1- 11 and an electrically operable atomizer (26) configured for vaporizing or atomizing liquid supplied from the liquid reservoir (34) and for providing vaporized or atomized liquid as an aerosol where the atomizer (26) is operable when connected to a battery (18) of the electronic smoking device (10) to atomize liquid stored in the liquid reservoir (34) as an aerosol.

15. The electronic smoking device of claim 14 further comprising a battery portion (12) comprising the battery (18).

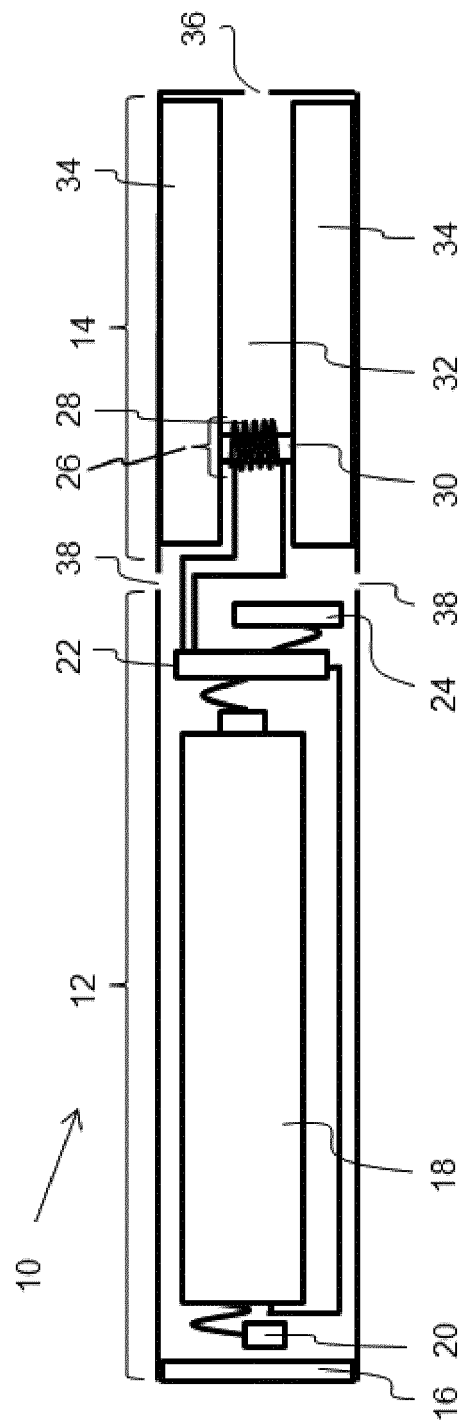


Fig.1

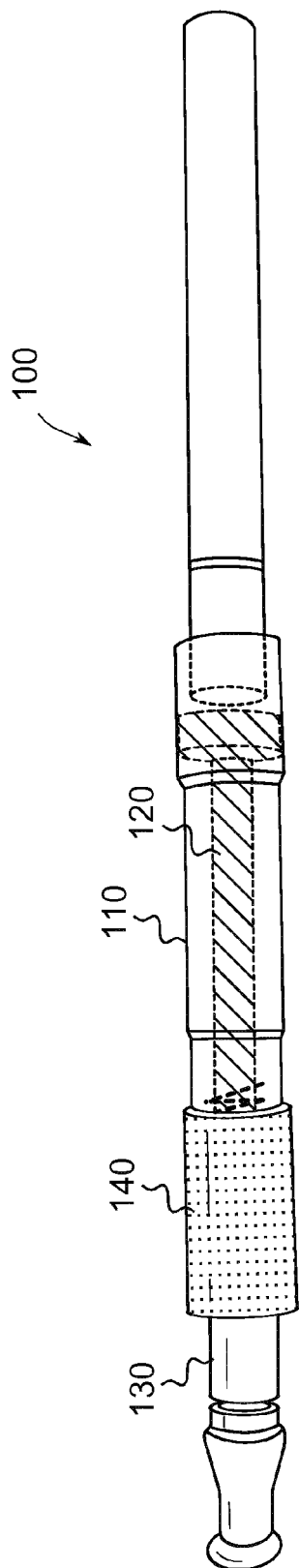


Fig. 2

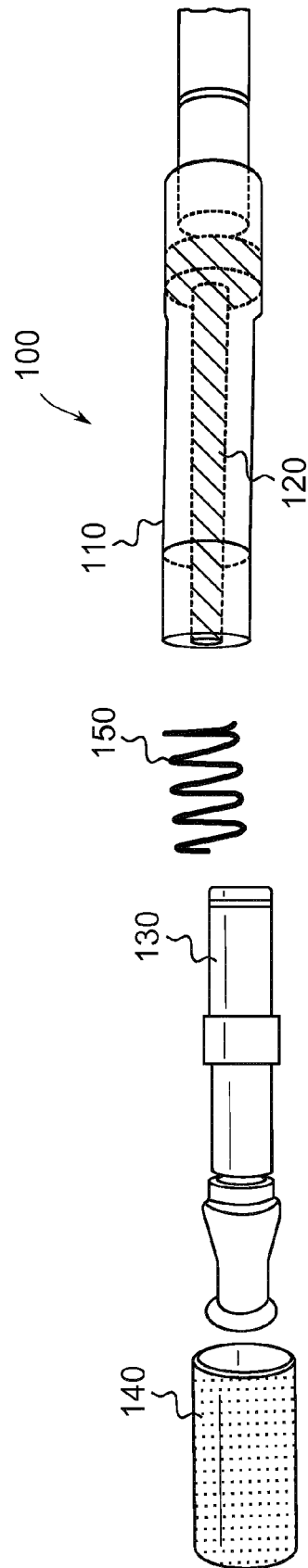
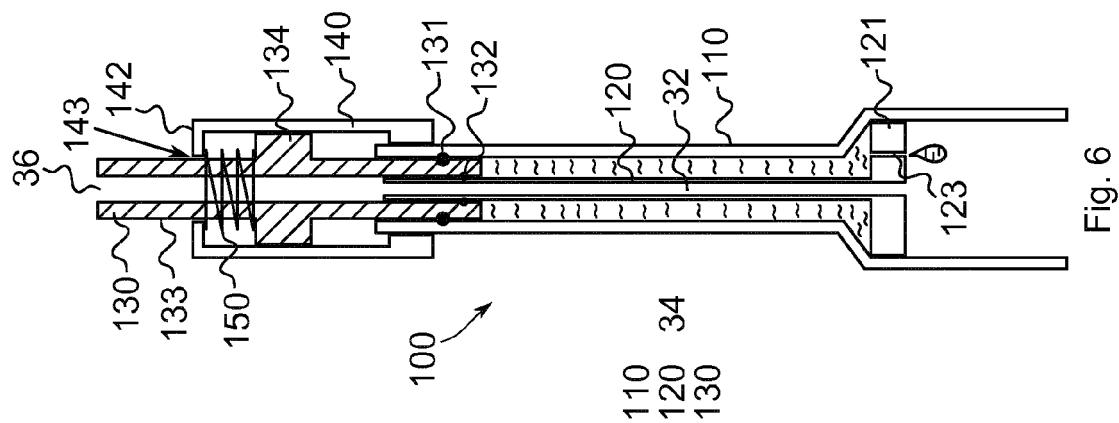
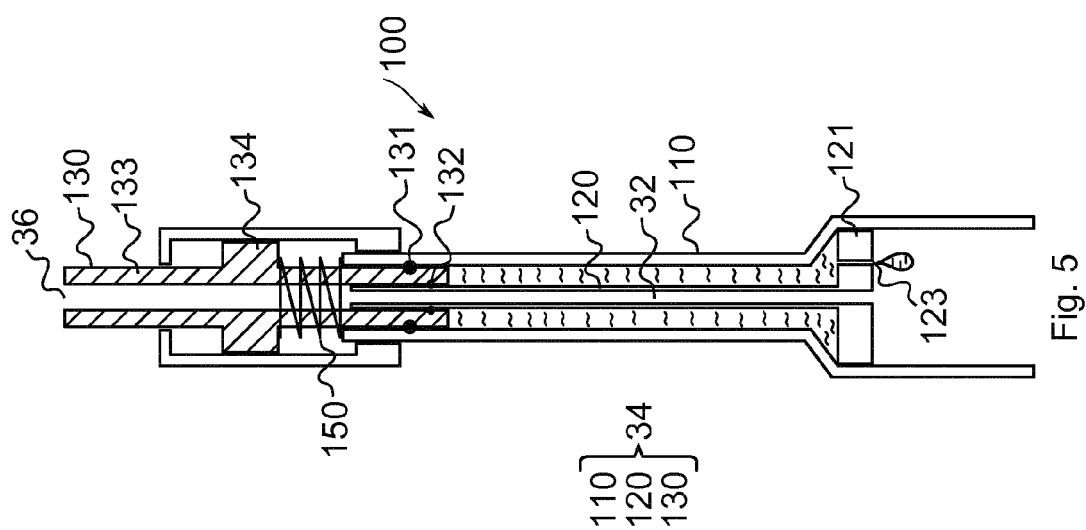
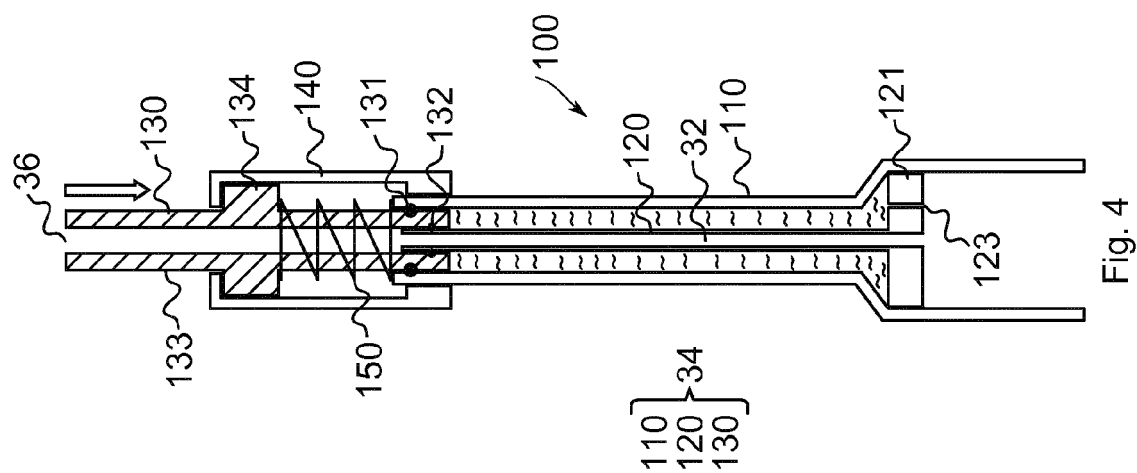
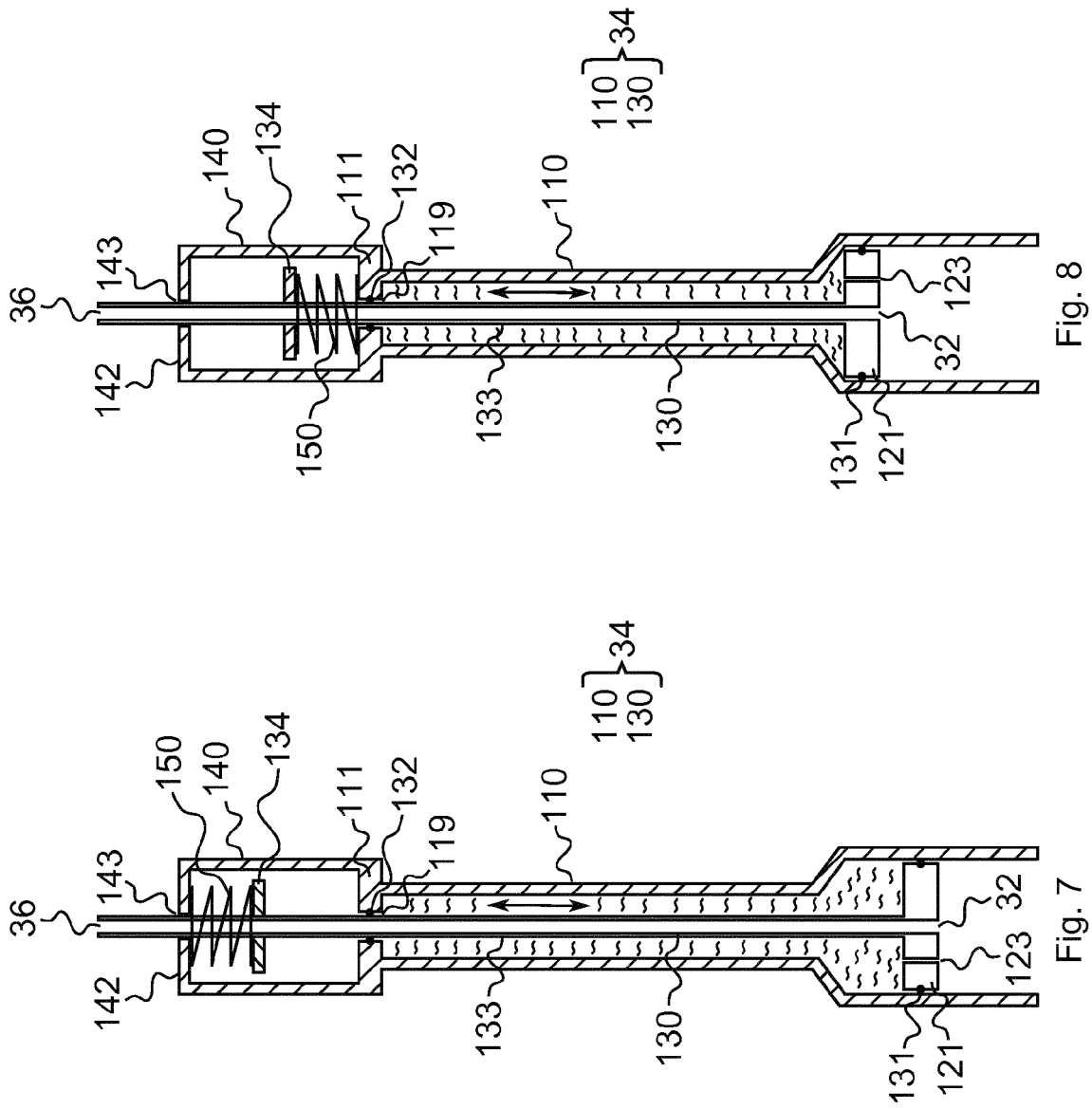


Fig. 3







## EUROPEAN SEARCH REPORT

 Application Number  
 EP 15 19 1933

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EPO FORM 1503 03.82 (P04C01)

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                               |                                                         |                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                 | Relevant to claim                                       | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2015/272216 A1 (DAI WEI [CN] ET AL)<br>1 October 2015 (2015-10-01)<br>* the whole document *               | 1-15                                                    | INV.<br>A24F47                          |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WO 2015/077645 A1 (CORR TECH ASSOCIATES INC [US]) 28 May 2015 (2015-05-28)<br>* the whole document *          | 1-15                                                    |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2015/027471 A1 (FELDMAN ZVIKA [IL] ET AL) 29 January 2015 (2015-01-29)<br>* the whole document *           | 1-15                                                    |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US 2013/213418 A1 (TUCKER CHRISTOPHER S [US] ET AL) 22 August 2013 (2013-08-22)<br>* the whole document *     | 1-15                                                    |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | WO 2015/079197 A1 (TWENTY SIXTEEN 2016 PHARMA LTD [GB]) 4 June 2015 (2015-06-04)<br>* the whole document *    | 1-15                                                    |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP 0 307 118 A1 (INVENTOR S FUNDING COMPANY LTD [IL])<br>15 March 1989 (1989-03-15)<br>* the whole document * | 1-15                                                    | TECHNICAL FIELDS SEARCHED (IPC)<br>A24F |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                               |                                                         |                                         |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                               | Date of completion of the search<br><b>4 April 2016</b> | Examiner<br><b>Cardan, Cosmin</b>       |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                               |                                                         |                                         |

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 19 1933

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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04-04-2016

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| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                                         | Publication<br>date                                                                                                        |
|-------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| US 2015272216 A1                          | 01-10-2015          | NONE                                                                                                                                                               |                                                                                                                            |
| WO 2015077645 A1                          | 28-05-2015          | NONE                                                                                                                                                               |                                                                                                                            |
| US 2015027471 A1                          | 29-01-2015          | US 2015027471 A1<br>WO 2015011565 A2                                                                                                                               | 29-01-2015<br>29-01-2015                                                                                                   |
| US 2013213418 A1                          | 22-08-2013          | AU 2013222232 A1<br>CA 2864832 A1<br>CN 104254356 A<br>EP 2817051 A1<br>JP 2015511128 A<br>KR 20140135750 A<br>MA 35934 B1<br>US 2013213418 A1<br>WO 2013126770 A1 | 04-09-2014<br>29-08-2013<br>31-12-2014<br>31-12-2014<br>16-04-2015<br>26-11-2014<br>01-12-2014<br>22-08-2013<br>29-08-2013 |
| WO 2015079197 A1                          | 04-06-2015          | GB 2522727 A<br>WO 2015079197 A1<br>WO 2015079198 A1                                                                                                               | 05-08-2015<br>04-06-2015<br>04-06-2015                                                                                     |
| EP 0307118 A1                             | 15-03-1989          | AU 2179188 A<br>CA 1329098 C<br>EP 0307118 A1<br>IL 83826 A<br>JP S6471472 A<br>US 4911181 A<br>ZA 8806392 A                                                       | 09-03-1989<br>03-05-1994<br>15-03-1989<br>10-03-1991<br>16-03-1989<br>27-03-1990<br>30-05-1989                             |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82