smoke-free cigarette, but said method makes use of a fluid stream which has already been acted upon by heat due to the combustion of liquefied gas and which is provided by means of the process described in WO2008/113420, whereas it is not possible to accomplish a purely electrical generation of an adequately hot fluid stream in the space available in a cigarette or a small cigar because there is not enough space for a heat exchanger.

[0028] WO2008/113420 describes a method for volatilizing active and/or aroma substances for the purpose of releasing an inhalable aerosol, wherein combustion gases of a flammable gas, which is preferably combusted with an excess of air, are passed partially or entirely, optionally mixed with ambient air, through an active and/or aroma substance reservoir and wherein a desired temperature is selectable by the proportion of combustion gases and optionally by the mixing ratio of said combustion gases with ambient air.

[0029] An essential disadvantage of this method is the use of liquefied gas, which has the effect that, due to the supposed explosion risk in the immediate vicinity of the consumer's face, even though this risk is only hypothetical and can be governed by a fail-safe design, there will be security concerns on the part of potential customers on the one hand and a high probability that products based on this principle will not be allowed aboard an aircraft on the other.

~~Object~~Summary of the invention

[0030] ~~It is therefore an object~~Embodiments of the present invention ~~to~~ provide a device for electronic cigarettes which guarantees a vaporization of nicotine and/or additives without reusable components that come into contact with the fluid to be vaporized, and to preferably accomplish at the same time a substantial reduction of costs and ecological damage by reducing the amount of material used and by optimizing machine processability.

General description of the invention

[0030a] According to an aspect, there is provided a vaporizer device for vaporizing substances containing active and/or aroma materials, configured as a mouthpiece with a fluid inlet and a fluid outlet, comprising: a heating device with a thermal resistor in the form of a metallic foil or a thin sheet configured as a dual coil and/or sinuous line with two ends and dimensions of the cross-section of a cigarette or a small cigar, wherein the interspaces of the dual coil and/or sinuous line of the thermal resistor are open and allow thus a flow of fluid therethrough, and wherein at least one respective contact tab consisting of a metallic foil or a thin sheet is connected to a respective end of the dual coil and/or sinuous line of the thermal resistor, the contact tabs, which are connected to the

respective opposed end of the dual coil and/or sinuous line of the thermal resistor, not being in direct contact with one another, and at least one vaporizer membrane which is in large-area contact with the thermal resistor, which is also permeable to flowing fluids and which is wetted or can be wetted with a substance containing active and/or aroma materials to be vaporized, wherein the thermal resistor and the at least one vaporizer membrane are arranged orthogonally or at an angle to the direction of the fluids passing through the mouthpiece.

[0031] ~~According to~~Embodiments of the present invention~~, this object is achieved by~~ disclose a heating device ~~of the type described in claim 1~~ and a vaporizer device used for vaporizing fluids from permeable vaporizer membranes (similar to those described in WO2011/009920) and including such a heating device, said heating device comprising:

- a permeable thermal resistor foil configured as a dual coil and/or sinuous line with two ends and dimensions of the cross-section of a cigarette or a small cigar, wherein the interspaces of the dual coil and/or sinuous line of the thermal resistor (1) are open (permeable) and allow thus a flow of fluid therethrough.

at least two electric contacts (contact tabs) which are fixedly connected to the respective opposed end of the thermal resistor foil on one side thereof and which

are exposed on the other side thereof, which allows them to be releasably connected to a controlled or regulated voltage source, the thermal resistor foil and the electric contacts being preferably made of one piece.

[0032] ~~In the sense~~In embodiments of the present invention, the term permeable means for the thermal resistor foil as well as for the vaporizer membranes that they allow gas to pass therethrough (permeable to gas) in the direction of their surface normal.

[0033] According to embodiments of the present invention, a permeable thermal resistor foil consists of an electrically conductive foil, which is preferably subjected to punching or laser cutting so as to obtain a dual coil or a sinuous line shape or a combination of dual coil and sinuous line shapes. In case of a combination of dual coil and sinuous line shapes the thermal resistor may include, for example, two partial areas with sinuous line shapes having an interposed partial area in the form of a dual coil, or with a dual coil having a central partial area in the form of a sinuous line. Other combinations with additional, different partial areas are possible as well.

[0034] The thermal resistor foil according to embodiments of the invention consists of an electrically conductive material, preferably an aluminum or high-quality steel alloy, and more preferably of a food-safe pure aluminum, an AlMn alloy or stainless steel, such as X5CrNi18-10.

[0035] The wall thickness of a permeable thermal resistor foil according to embodiments of the present invention is between 0.01 mm and 0.2 mm, preferably, however, it is between 0.02 mm and 0.08 mm.

[0036] Depending on the electric conductivity of the fluid to be vaporized, the thermal resistor foil can be coated with a heat-resistant and electrically insulating plastic layer, preferably a layer of polyimide, micanite or silicone, thus avoiding a short circuit if the electric resistance of the fluid to be vaporized should be too low in comparison with the resistance of the thermal resistor foil. Micanite in the sense of the present invention generally refers to artificial mica, i.e. a composite material comprising broken bits of mica (broken bits of layered silicate) and artificial resin as a matrix system. Exemplary products: flexible micanite FLM M & P (consisting of at least 92% of muscovite or, alternatively, phlogopite, impregnated with a high temperature resistant silicone binding agent), flexible micanite FLM 521 P, etc.

[0037] Such a heating device can be used e.g. as an electric thermal resistor in a vaporizer device for vaporizing substances containing active and/or aroma materials, e.g. in a disposable, single-use mouthpiece for an electronic cigarette. By simply attaching the heating device to a battery unit including a vacuum switch or vacuum governor, the electronic cigarette will be readyfor use. When the current circuit is closed by the vacuum switch or

vacuum governor, the thermal resistor foil will heat and vaporize the fluid from the vaporizer membrane.

[0038] Another ~~aspect~~embodiment therefore concerns a vaporizer device for vaporizing substances containing active and/or aroma materials, preferably configured as a mouthpiece in the form of a hollow cylinder with a fluid inlet and a fluid outlet. The vaporizer device comprises a heating device of the type described here and at least one vaporizer membrane which is in large-area contact with the thermal resistor. The vaporizer membrane is also permeable to flowing fluids and is either wetted or can be wetted with a substance containing active and/or aroma materials to be vaporized. The thermal resistor and the vaporizer membrane(s) are preferably arranged orthogonally or at an angle to the direction of the fluids passing through the mouthpiece.

[0039] The above-described structural design of the vaporizer device achieves not only a very high vaporizing efficiency but also the highest possible degree of vaporization uniformity due to fact that the invention provides the largest possible contact area between the thermal resistor foil and the vaporizer membrane or vaporizer membranes.

[0040] Another essential advantage of the embodiments of invention is that, by varying the geometrical configuration of the thermal resistor foil, e.g. by varying the number of coil windings, the width of the windings and/or the wall thickness of the foil or of the thin sheet, the power of the thermal resistor can be adapted in the best possible way to various substances to be vaporized, which contain different materials.

[0041] By choosing adequate materials as well as adequate geometrical parameters of the thermal resistor foil, the electric resistance of the thermal resistor foil can be adjusted in the range of 1 – 10 Ω (Ohm), whereby a spectrum of 0.1 – 13.7 Watt heating power in the cross-section of a cigarette mouthpiece can be covered with a possible nominal voltage of an attached battery unit of 1.2 V (NiCd) – 3.7 V (Li-ion).

[0042] Another important advantage of the embodiments of invention is that, by providing a local constriction (narrowing), a safety fuse can be integrated in the contour of the thermal resistor foil. When the fluid has been consumed, this safety fuse will be thermally destroyed due to the then no longer existing cooling, and the mouthpiece will be rendered useless, whereby a single-use mouthpiece with a specific consumption time of 5 – 20 puffs per 20 – 50 ml, preferably, however, with 8 – 12 puffs per 35 ml, can be obtained in a particularly easy manner.

[0043] According to a further embodiment, the vaporizer device additionally comprises a flange for releasably connecting a controlled or regulated electric voltage source by the electric poles, the contact tabs, which are connected to the respective opposed end of the

dual coil and/or sinuous line of the thermal resistor, not being in direct contact with one another, i.e. they are only in contact with one another via the thermal resistor. These contact tabs are adapted to be connected via the flange to the electric poles of a controlled or regulated electric voltage source.

[0044] Preferably, an insulation foil covers the contact tabs towards a flange area on the inner side of the hollow cylinder of the mouthpiece. The insulation foil includes, preferably in the region of said flange area, at least two axially displaced contact openings, said contact openings being preferably configured such that they are axially located in one plane and expose each only one contact tab. The poles of a controlled or regulated electric voltage source are e.g. two axially displaced rings, and, in the connected condition of the mouthpiece and the voltage source, a respective pole of the voltage source is connected via the contact openings to the contact tabs and via the contact tabs to a respective end of the dual coil and/or the sinuous line of the thermal resistor.

[0045] According to a further embodiment, the contact tabs and/or the flange area preferably include at least one locating groove and/or locating projection, said locating groove and/or locating projection having a complementary counterpart configured as at least one locating projection and/or locating groove on the controlled or regulated electric voltage source. In the connected condition of the mouthpiece and the voltage source, a respective pole of the voltage source is connected to the contact tabs and via the contact tabs to a respective end of the dual coil and/or the sinuous line of the thermal resistor.

[0046] According to another preferred embodiment, at least one pointed and/or sharp-edged opening tab consisting of a metallic foil or a thin sheet, preferably (but not coercively) of the same metallic foil, respectively same thin sheet, as the thermal resistor, extends, with its pointed and/or sharp-edged side first, from the thermal resistor axially in the direction of the flange of the mouthpiece and is implemented such that, when the mouthpiece and the voltage source are being connected, a sealing foil of a storage cartridge between the thermal resistor and the flange is punctured and/or cut open by said opening tab, said storage cartridge being filled with a substance containing active and/or aroma materials.

[0047] Hence, embodiments of the present invention not only allows the provision of a combination of storage and vaporization functions in a single-use mouthpiece which, in comparison with known devices of this type, provides a more efficient vaporization and a reduction of the amount of resources consumed, but it also offers a precisely defined, temporally limited consumer experience.

[0048] Due to the fact that the above-described thermal resistor foil is preferably produced by means of punching or die bending, this production can excellently be integrated in a fast-