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(54) **AEROSOL DELIVERING SYSTEM COMPRISING A HYDROPHOBIC MATERIAL, AND ASSOCIATED CARTRIDGE AND AEROSOL GENERATING ASSEMBLY**

(57) The present invention concerns an aerosol delivering system (10) for an aerosol generating device, the aerosol delivering system comprising a reservoir (31) storing a liquid vaporizable material, and a porous element (32) arranged in fluid communication with the reservoir (31) and designed to be in contact with a heater (25);

the porous element (32) defining a contact surface (41) designed to be in contact with the liquid vaporizable material and a vaporizing surface (43) designed to release aerosol formed upon heating the liquid vaporizable material by the heater (25); wherein the vaporizing surface (43) is coated with a hydrophobic material forming a liquid barrier.

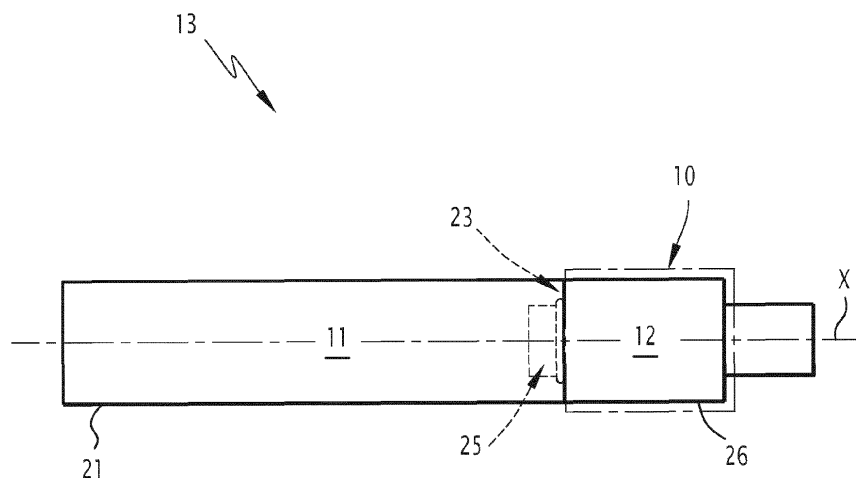


FIG.1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns an aerosol delivering system comprising a hydrophobic material. The present invention also concerns a cartridge and an aerosol generating assembly comprising such an aerosol delivering system.

BACKGROUND OF THE INVENTION

[0002] The popularity and use of reduced-risk or modified-risk devices (also known as vaporisers or aerosol generating devices) has grown rapidly in the past few years as an aid to assist habitual smokers wishing to quit smoking traditional tobacco products such as cigarettes, cigars, cigarillos, and rolling tobacco.

[0003] Different types of aerosol generating devices are known in the art. Generally, such devices comprise a reservoir for storing a vaporizable material, also known as aerosol forming precursor, which can comprise for example a liquid or a solid. A heating system is formed of one or more electrically activated resistive elements arranged to heat said precursor to generate the aerosol. The aerosol is released into an airflow path extending between an inlet and outlet of the device. The outlet may be arranged in a mouthpiece, through which a user inhales for delivery of the aerosol.

[0004] The aerosol generating devices comprise generally a battery able to power the heating system. The powering may be controlled by a control module connecting the heating system to the battery via an electric circuit.

[0005] In some aerosol generating devices, the precursor is stored in a removable cartridge. Thus, when the precursor is consumed, the cartridge can be easily removed and replaced.

[0006] For a liquid vaporizable material, a wicking system is generally used to deliver the vaporizable material to the heating system. The wicking system may comprise a porous element in contact with both reservoir storing the vaporizable material and heating system. However, when the aerosol generating device is not used to generate aerosol, the wicking system can cause leakage of the vaporizable material.

SUMMARY OF THE INVENTION

[0007] One of the aims of the present invention is to propose an aerosol delivering system minimizing the risk of vaporizable material leakage.

[0008] For this purpose, the invention relates to an aerosol delivering system for an aerosol generating device, the aerosol delivering system comprising a reservoir storing a liquid vaporizable material, and a porous element arranged in fluid communication with the reservoir and designed to be in contact with a heater;

the porous element defining a contact surface designed to be in contact with the liquid vaporizable material and a vaporizing surface designed to release aerosol formed upon heating the liquid vaporizable material by the heater; wherein the vaporizing surface is coated with a hydrophobic material forming a liquid barrier.

[0009] Particularly, provided with these features, the vaporizable material in liquid form can be blocked in the reservoir preventing thus any leakage when the device is not being used. On the contrary, when the aerosol generating device is being used to generate aerosol, the porous element is heated by the heater and aerosol formed in the porous element can be released in the airflow path through the liquid barrier.

[0010] According to some embodiments, wherein the hydrophobic material is chosen to be liquid impermeable and gas permeable.

[0011] Thanks to these features, it is possible to ensure that all aerosol formed inside the porous element during the operation of the device is released in the airflow path. Thus, the operation of the heater can be efficient.

[0012] According to some embodiments, the hydrophobic material comprises rare earth oxides.

[0013] According to some embodiments, the hydrophobic material comprises fluorosilanes.

[0014] According to some embodiments, the hydrophobic material comprises a porous lanthanide oxide layer.

[0015] According to some embodiments, the hydrophobic material is resistant up to 250°C, advantageously up to 300°C.

[0016] Thanks to these features, the porous element can be heated until an optimal temperature to form aerosol without deteriorating the properties of the coating formed by the hydrophobic material.

[0017] According to some embodiments, the liquid barrier formed by the hydrophobic material defines a porous structure with porous substantially thicker than porous formed by the porous element.

[0018] Thanks to these features, it is possible to adapt the dimensions of the porous structure so as to retain the vaporizable material in liquid form in the reservoir. Generally, the particles forming aerosol have smaller dimensions than the liquid droplets so as the aerosol formed from the liquid material can pass through the liquid barrier.

[0019] According to some embodiments, the vaporizing surface is arranged perpendicularly to the contact surface.

[0020] Thanks to these features, a particular arrangement of the porous element, the airflow path and the reservoir can be achieved. For example, according to this arrangement, the airflow path can extend through the reservoir and the porous element can be heated by an external heater.

[0021] According to some embodiments, the vaporiz-

ing surface is in fluid communication with an airflow path.

[0022] Thanks to these features, the aerosol can be released directly to the airflow path avoiding thus pressure drops.

[0023] According to some embodiments, the vaporizing surface is arranged around the airflow path.

[0024] Thanks to these features, the aerosol can be released homogeneously to the airflow path.

[0025] According to some embodiments, the porous element further defines a heating surface designed to be in contact with the heater, the heating surface being different from each of the contact surface and the vaporizing surface.

[0026] Thanks to these features, the porous element can be heated directly by the heater without affecting the other surfaces of the porous element and notably, without affecting the contact surface or the vaporizing surface.

[0027] According to some embodiments, the porous element is made of ceramic.

[0028] Thanks to these features, the porous element can form a solid and heat resistant element.

[0029] According to some embodiments, the porous element has an annular shape.

[0030] Thanks to these features, the aerosol can be released homogeneously to the airflow path.

[0031] The present invention also relates to a cartridge configured to operate with an aerosol generating device, the cartridge comprising an aerosol delivering system as defined above.

[0032] The present invention also relates to an aerosol generating assembly comprising an aerosol delivering system as defined above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The invention and its advantages will be better understood upon reading the following description, which is given solely by way of non-limiting example and which is made with reference to the appended drawings, in which:

- Figure 1 is a schematic diagram showing an aerosol generating assembly according to the invention, the aerosol generating assembly comprising an aerosol delivering system according to the invention;
- Figure 2 is a cross-sectional view of a part of the aerosol generating assembly of Figure 1 showing in more detail the aerosol delivering system, the aerosol delivering system comprising a porous element; and
- Figure 3 is a schematic view showing a liquid barrier formed on a surface of the porous element of Figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Before describing the invention, it is to be understood that it is not limited to the details of construction set forth in the following description. It will be apparent to those skilled in the art having the benefit of the present disclosure that the invention is capable of other embodiments and of being practiced or being carried out in various ways.

[0035] As used herein, the term **"aerosol generating device"** or **"device"** may include a vaping device to deliver an aerosol to a user, including an aerosol for vaping, by means of aerosol generating unit (e.g. an aerosol generating element which generates vapor which condenses into an aerosol before delivery to an outlet of the device at, for example, a mouthpiece, for inhalation by a user). The device may be portable. "Portable" may refer to the device being for use when held by a user. The device may be adapted to generate a variable amount of aerosol, e.g. by activating a heating system for a variable amount of time (as opposed to a metered dose of aerosol), which can be controlled by a trigger. The trigger may be user activated, such as a vaping button and/or inhalation sensor. The inhalation sensor may be sensitive to the strength of inhalation as well as the duration of inhalation to enable a variable amount of vapor to be provided (so as to mimic the effect of smoking a conventional combustible smoking article such as a cigarette, cigar or pipe, etc.). The device may include a temperature regulation control to drive the temperature of the heater and/or the heated aerosol generating substance (aerosol precursor) to a specified target temperature and thereafter to maintain the temperature at the target temperature that enables efficient generation of aerosol.

[0036] As used herein, the term **"aerosol"** may include a suspension of precursor as one or more of: solid particles; liquid droplets; gas. Said suspension may be in a gas including air. Aerosol herein may generally refer to/include a vapor. Aerosol may include one or more components of the precursor.

[0037] As used herein, the term **"vaporizable material"** or **"aerosol-forming precursor"** may refer to one or more of a: liquid; solid; gel; mousse; foam or other substances. The vaporizable material may be processable by the heating system of the device to form an aerosol as defined herein. The vaporizable material may comprise one or more of: nicotine; caffeine or other active components. The active component may be carried with a carrier, which may be a liquid. The carrier may include propylene glycol or glycerin. A flavoring may also be present. The flavoring may include Ethylvanillin (vanilla), menthol, Isoamyl acetate (banana oil) or similar. A solid aerosol forming substance may be in the form of a rod, which contains processed tobacco material, a crimped sheet or oriented strips or shreds of reconstituted tobacco (RTB).

[0038] As used herein, the term **"hydrophobic material"** may refer to any material having properties of liquid

repealing. Particularly, in contact with a hydrophobic material, the droplets of a liquid, like a liquid vaporisable material, form a contact angle greater than 90°. According to different embodiments of the invention, the hydrophobic material can comprises rare earth oxides, notably lanthanide series rare earth oxides (REOs). The hydrophobic material may also form or comprise a porous lanthanide oxide layer. In some embodiments, the hydrophobic material can comprises silanes, notably fluorosilanes.

[0039] Figure 1 shows an aerosol delivering system 10 according to the invention. Particularly, according to the example of this figure, the aerosol delivering system 10 is integrated entirely in a removable cartridge 12 which is adapted to operate with an aerosol generating device 11. In this case, the aerosol generating device 11 forms together with the removable cartridge 12 an aerosol generating assembly 13 according to the invention. According to other examples of the invention, the aerosol delivering system 10 is integrated at least partially in the aerosol generating device 11 and at least partially in the removable cartridge 12. In this case, the aerosol generating device 11 also forms together with the removable cartridge 12 an aerosol generating assembly 13 according to the invention. According to still other examples of the invention, the aerosol delivering system 10 is integrated entirely in the aerosol generating device 11 which can for example be adapted to operate without removable cartridge. In this last case, the aerosol generating device 11 forms an aerosol generating assembly 13 according to the invention.

[0040] As it is shown on Figure 1, the aerosol generating device 11 extends along a device axis X and comprises a device body 21 having for example a cylindrical shape for example with a circular cross-section. The device body 21 delimits a cavity 23 configured to receive, at least partially, the removable cartridge 12. The device body 21 further delimits an internal space of the device 11 receiving various elements designed to carry out different functionalities of the device 11. This internal space can for example receive a power block for powering the device 11, a control module for controlling the operation of the device 11 and at least a device part of heating system configured to heat a vaporisable material contained in the removable cartridge 12. In the example of Figure 1, the heating system is entirely formed by its device part and comprises notably a heater 25 powered by the power block through the control module and designed to be in contact with an external surface of the removable cartridge 12 as it will be explained in further detail below. According to other examples of the invention, the device part of heating system is formed by a pair of contacts designed to be powered by the power block through the control module. Other examples of the device part of heating system are still possible. The internal space of the device body 21 may further comprise other internal components performing different functionalities of the device 11 known *per se*. These internal components will not

be explained in detail below.

[0041] It should also be noted that Figure 1 presents only a schematic diagram of the aerosol generating device 11 and cartridge 12, and does not necessarily show the real physical arrangement and dimensions of these elements. Particularly, such an arrangement can be chosen according to the design of the aerosol generating device 11 or the cartridge 12 and technical features of their components.

[0042] As mentioned above, according to the example of Figure 1, the aerosol delivering system 10 is entirely integrated in the cartridge 12. For example, this aerosol delivering system 10 can be arranged entirely inside a cartridge body 26 delimiting the cartridge 12. As the device body 21, the cartridge body 26 can extend along the device axis X when the cartridge 12 is received in the cavity 23 and has for example a substantially cylindrical shape for example with a circular cross-section. The cartridge body 26 is shown in further detail on Figure 2.

[0043] Referring to this Figure 2, the aerosol delivering system 10 comprises a reservoir 31 storing a liquid vaporizable material as defined above, and a porous element 32 arranged in fluid communication with the reservoir 31 and designed to be in contact with the heater 25.

[0044] The reservoir 31 is for example arranged in the space formed between walls delimiting the cartridge body 26 and an airflow path 35 extending through the cartridge body 26 until a mouthpiece, according to the device axis X when the cartridge 12 is received in the cavity 23. The reservoir 31 can thus form an annular cylindrical shape extending according to at least a half, advantageously three quarters, of the total longitudinal extension of the cartridge body 26. In the example of Figure 2, the reservoir 31 forms an annular opening at its end adjacent to the porous element 32.

[0045] The porous element 32 is for example solid and formed from a heat-resistant material like ceramic. Additionally, the material forming the porous element 32 has relatively high heat transfer properties. The porous element 32 defines a contact surface 41 designed to be in contact with the liquid vaporizable material, a vaporizing surface 43 designed to release aerosol formed upon heating the liquid vaporizable material by the heater 25 and a heating surface 45 designed to be in contact with the heater 25. Advantageously, according to the invention, all these surfaces 41, 43, 45 are different one from the other.

[0046] In the example of Figure 2, the porous element 32 has an annular shape and is adjacent to the opening formed by the reservoir 31. Particularly, in this case, the contact surface 41 is perpendicular to the device axis X when the cartridge 12 is received in the cavity 23 and can cover entirely the opening formed by the reservoir 31. In some cases, a sealing member, like a gasket, can be provided to seal entirely this opening by the contact surface 41.

[0047] The heating surface 45 is for example opposite to the contact surface 41. Additionally, in the example of

Figure 1, the heating surface 45 can form an external surface of the cartridge body 26 which is intended to be in tight contact with the heater 25 when the cartridge 12 is received in the cavity 23. For this purpose, the cartridge 12 and/or the device 11 can form fixing means applying a mechanical force to abut the heating surface 45 against the heater 25. In this case, the heater 25 can also form an annular shape, like for example a coil, to be in contact with the heating surface 45 along its whole circumference. According to other examples of the invention, the heater 25 may be integrated in the cartridge body 26. In this case, the heating system of the assembly 13 comprises therefore a cartridge part which is formed by the heater 25 and is connected for example electrically to the device part. Additionally, in this case, the heater 25 can be arranged in contact with the heating surface 45 inside the cartridge body 26 in any suitable way.

[0048] In the example of Figure 2, the vaporizing surface 43 is formed by an internal surface of the annular porous element 32. It can thus extend around and along the device axis X when the cartridge 12 is received in the cavity 23. The vaporizing surface 43 can also for example extend the airflow path 35 until the heater 25, as it is shown on Figure 2. The vaporizing surface 43 is therefore perpendicular to both contact surface 41 and heating surface 45.

[0049] According to the invention, the vaporizing surface 43 is coated with a hydrophobic material forming a liquid barrier. The hydrophobic material can be any suitable material as defined above. Particularly, the hydrophobic material is chosen to be liquid impermeable and gas permeable. Thus, when the device 11 is not being operated to heat the vaporizable material, the vaporizing surface 43 forms a liquid barrier preventing liquid passage from the reservoir 31. When the device 11 is being operated to heat the vaporizable material, the heater 25 heats the porous element 32 and the liquid comprised in the porous element 32 or being in contact with the contact surface 41 can be vaporized forming aerosol. Since the vaporizing surface 43 is gas permeable, the aerosol can thus be released to the airflow path 35.

[0050] In some examples, the coating of the vaporizing surface 43 can also form a porous structure as the porous element 32 itself. However, the porous' dimensions of the coating can be smaller in comparison with those of the porous element 32 so as to block liquid from the porous element 32 as it shown on Figure 3. The porous' dimensions of the coating and the porous element 32 allow aerosol passage through these elements.

Claims

1. An aerosol delivering system (10) for an aerosol generating device (11), the aerosol delivering system (11) comprising a reservoir (31) storing a liquid vaporizable material, and a porous element (32) arranged in fluid communication with the reservoir (31)

and designed to be in contact with a heater (25);

the porous element (32) defining a contact surface (41) designed to be in contact with the liquid vaporizable material and a vaporizing surface (43) designed to release aerosol formed upon heating the liquid vaporizable material by the heater (25);

wherein the vaporizing surface (43) is coated with a hydrophobic material forming a liquid barrier.

2. The aerosol delivering system (10) according to claim 1, wherein the hydrophobic material is chosen to be liquid impermeable and gas permeable.
3. The aerosol delivering system (10) according to claim 1 or 2, wherein the hydrophobic material comprises rare earth oxides.
4. The aerosol delivering system (10) according to any one of the preceding claims, wherein the hydrophobic material comprises fluorosilanes.
5. The aerosol delivering system (10) according to any one of the preceding claims, wherein the hydrophobic material comprises a porous lanthanide oxide layer.
6. The aerosol delivering system (10) according to any one of the preceding claims, wherein the hydrophobic material is resistant up to 250°C, advantageously up to 300°C.
7. The aerosol delivering system (10) according to any one of the preceding claims, wherein the liquid barrier formed by the hydrophobic material defines a porous structure with porous substantially thicker than porous formed by the porous element (32).
8. The aerosol delivering system (10) according to any one of the preceding claims, wherein the vaporizing surface (43) is arranged perpendicularly to the contact surface (41).
9. The aerosol delivering system (10) according to any one of the preceding claims, wherein the vaporizing surface (43) is in fluid communication with an airflow path (35).
10. The aerosol delivering system (10) according to claim 9, wherein the vaporizing surface (43) is arranged around the airflow path (35).
11. The aerosol delivering system (10) according to any one of the preceding claims, wherein the porous element (32) further defines a heating surface (45) designed to be in contact with the heater (25), the heat-

ing surface (45) being different from each of the contact surface (41) and the vaporizing surface (43).

12. The aerosol delivering system (10) according to any one of the preceding claims, wherein the porous element (32) is made of ceramic. 5
13. The aerosol delivering system (10) according to any one of the preceding claims, wherein the porous element (32) has an annular shape. 10
14. A cartridge (12) configured to operate with an aerosol generating device (11), the cartridge (12) comprising an aerosol delivering system (10) according to any one of the preceding claims. 15
15. An aerosol generating assembly (13) comprising an aerosol delivering system (10) according to any one of claims 1 to 13. 20

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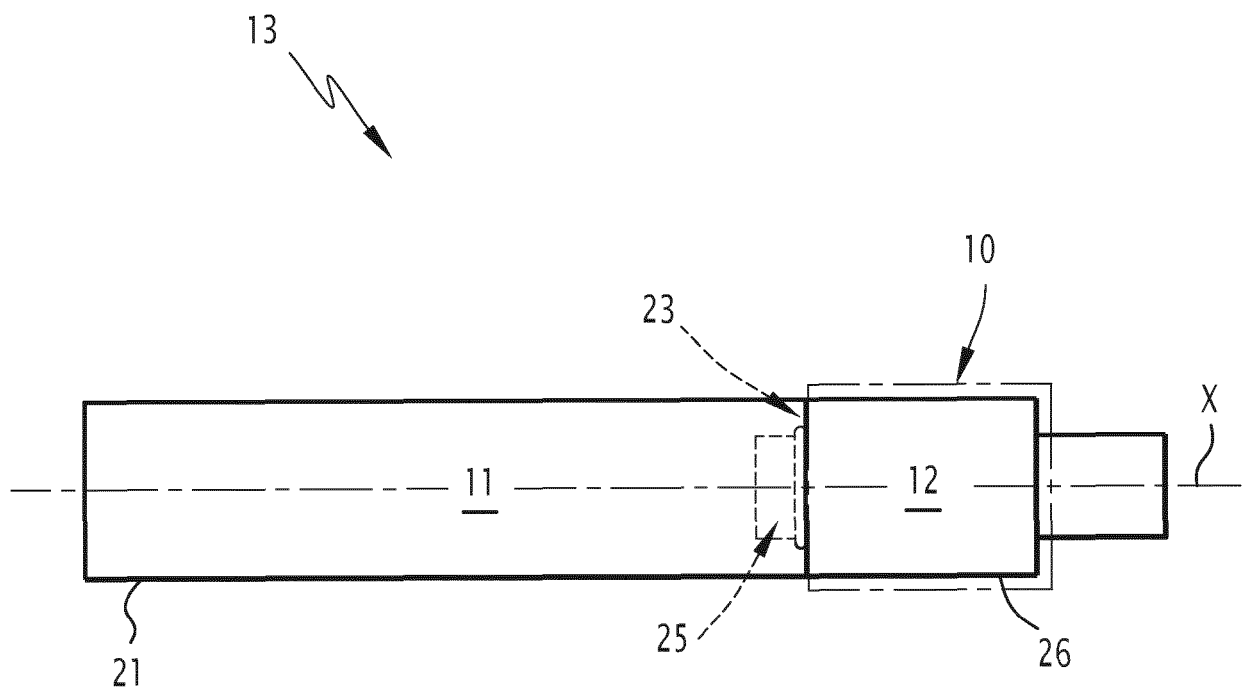


FIG.1

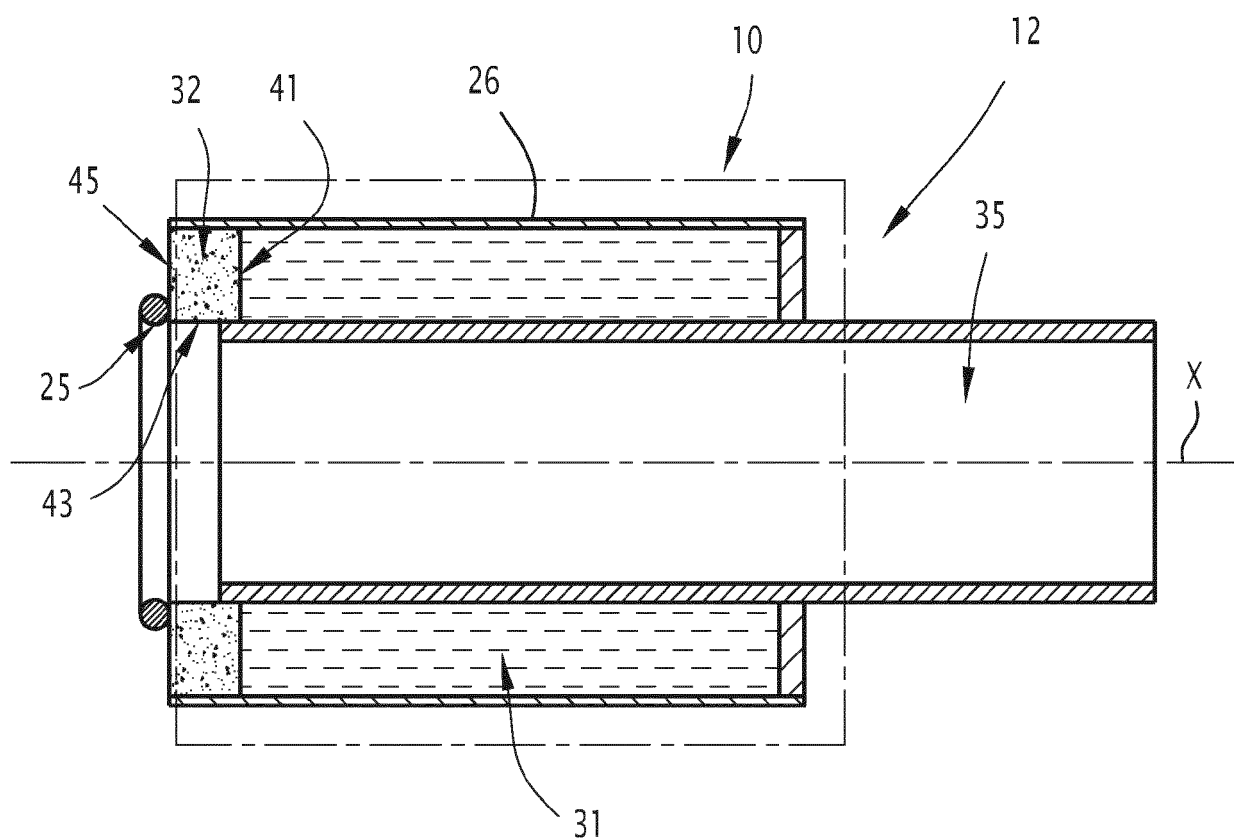


FIG.2

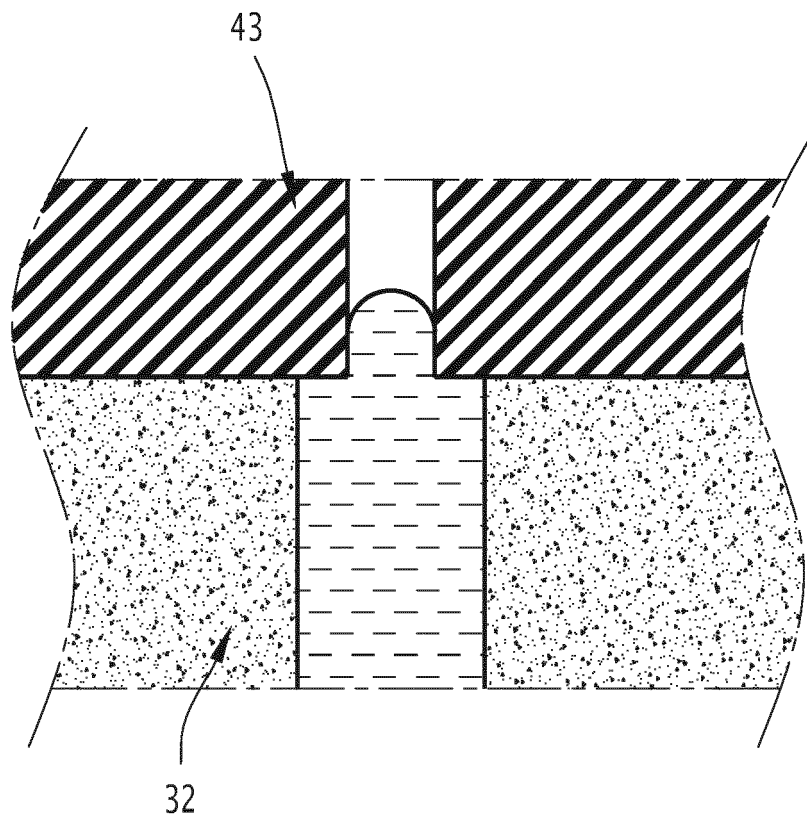


FIG.3



EUROPEAN SEARCH REPORT

Application Number

EP 22 15 6795

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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

**ANNEX TO THE EUROPEAN SEARCH REPORT
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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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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