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(54) **AN AEROSOL-GENERATING ARTICLE AND METHOD FOR PRODUCING AN AEROSOL**

(57) The invention relates to an aerosol generating article (1) configured for providing an aerosol by resistive effect upon being supplied with electrical voltage by electrodes of an aerosol generating device. The aerosol generating article (1) comprises a jellified electrically conductive substrate cast as a non-flowable body and its composition comprises: water, a gelling agent, an aerosol forming agent and at least one electrically water-sol-

uble conductive agent selected amongst: a salt, an acid or combinations thereof, the amount of water in the substrate represents at least 15 wt. % of the weight of the substrate. A method for producing an aerosol from such an aerosol generating article (1) by supplying electrical voltage by electrodes contacting the body to provide an aerosol by resistive effect in the substrate is disclosed, too.

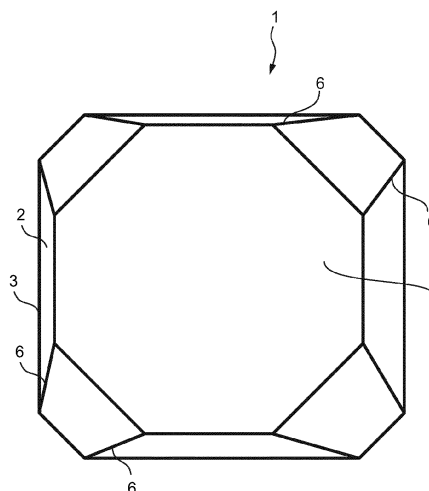


Fig. 1

Description

[0001] The present invention is directed to an aerosol generating article configured for providing an aerosol by resistive effect upon being supplied with electrical voltage by electrodes of an aerosol generating device. Furthermore, the invention is directed to a method for producing an aerosol from such an aerosol generating article.

[0002] In the last years the so-called reduced-risk or modified-risk devices (also known as vaporisers) have been become popular as an alternative to traditional tobacco products such as cigarettes, cigars, cigarillos, and rolling tobacco. Numerous devices and systems are available on the market. They have in common, that in contrast to the traditional products, a tobacco-based substrate or a flavored liquid substrate is heated below the combustion temperature to produce an aerosol and/or vapor for inhalation.

[0003] Until now, liquid substrate from which the aerosol is generated is usually provided in cartridges or pods. Once depleted, the cartridges or pods are disposed or collected for recycling, which results in large amounts of waste associated with the consumption of aerosol (or vapour). The cartridges or pods usually include plastics and metals. The heat resistant plastics are expensive and not recyclable or only with high efforts and costs. The large amounts of plastic waste and cost of the depleted cartridges or pods are deterring users from this format. The recyclability of the metal parts requires complex logistic and is usually expensive.

[0004] The known cartridge or pod may also comprise small parts (e.g., coil and wick or ceramic heater) which makes large scale production, in particular the product assembly, complicated.

[0005] Thus, it is an object of the invention to reduce waste resulting from cartridges or pods for aerosol generating devices. Furthermore, usage of exchangeable cartridges or pods for heat-not-burn devices should be facilitated.

[0006] It has been found that these problems could be overcome by an aerosol-generating article and a method according to the appended claims.

[0007] An aerosol-generating article according to the present invention is configured for providing an aerosol by resistive effect upon being supplied with electrical voltage by electrodes of an aerosol generating device. The article comprises a jellified and/or gel-like electrically conductive substrate cast as a non-flowable body. Its composition comprises: water, a gelling agent, an aerosol forming agent and at least one water-soluble electrolytic agent. The water-soluble electrolytic agent is selected from a group comprising: a salt, an acid or combinations thereof.

[0008] The amount of water in the substrate represents at least 15 wt. %, preferably more than 20 wt. % of the weight of the substrate.

[0009] The amount of water is preferably at most 50 wt. %, preferably at most 40 wt. %, most preferably at

most 35 wt. % of the weight of the substrate. Such an aerosol-generating article could be handled without a housing or body or skeleton, which has to be wasted after usage. The aerosol generating article is preferably also devoid of small heating parts that require complex handling. Thus, waste could be reduced and no handling or disposal of an empty cartridge or pod is necessary after usage of the article. Thus, handling is facilitated.

[0010] Preferably, the (electrical) resistance of the jellified conductive substrate is less than 2 Ohm, preferably between 0.5 - 1.5 Ohm, more preferably between 0.75 - 1.25 Ohm, most preferably between 0.9 - 1.1 Ohm. It has been found that a resistance in this range is suitable to be used with most of the aerosol-generating devices on the market. An aerosol-generating article having a jellified conductive substrate providing this resistance could be heated to release an aerosol with common batteries or rechargeable batteries used for handheld aerosol generating devices such as Lithium polymer (LiPo), Nickel Manganese Cobalt (NMC) or Lithium Iron Phosphate (LFP). It has been shown that a resistance in this range is particularly suitable for generating a temperature necessary to produce the aerosol at the voltages and currents commonly used in aerosol-generating devices.

[0011] Preferably, the aerosol-generating article comprises between about 1 and 10 wt. % gelling agent, preferably between about 1 and 5 % wt. gelling agent, more preferably at least between 1.5 - 2.5 % wt., more preferably between 1.75 - 2.25 % wt., most preferably between 1.9 - 2.1 % wt. gelling agent. With these proportions of the gelling agent the stability of the product and thus its easy handling is possible. However, the aerosol-generating article preferably remains flexible so that the contact of the conductive substrate with the electrodes can be improved. Especially a good contact with the electrodes is ensured to improve the conduction of the current.

[0012] In embodiments, the gelling agent is selected from a group comprising gellan gum, xanthan gum, agar agar or and combinations thereof. These gelling agents are available and cheap. Furthermore, they are approved as food additives.

[0013] Since the aerosol-generating article comprises the jellified conductive substrate cast as a non-flowable body, its geometry could be easily adapted to any desired geometry. The aerosol-generating article can be provided in any suitable geometry. However, symmetrical embodiments selected from a group comprising a platonic solid, a sphere, a tetrahedron, a cube, an octahedron, a dodecahedron, an icosahedron, an archimedean solid, a truncated cube, a rhombicuboctahedron, a snub cube, a truncated icosahedron, a (n-gonal) pyramid, a (n-gonal) dipyrmaid, preferably a triangular bipyramid, a square bipyramid, a pentagonal bipyramid or a hexagonal bipyramid, a hexagonal prism, a cone, a cylinder and a truncated (n-gonal) pyramid. These geometries are particularly easy to handle, may be easily fit in a receiving housing of the aerosol generating device and may allow a high recognition value for the consumer. For example, the

shape and size may be similar or close to a cuboid card, such as that of SIM card format, to maximise the surface area in contact with the electrodes to add in a faster vapour generation.

[0014] In embodiments in which at least one water-soluble electrolytic agent is an acid, the acid preferably comprises an acid selected from a group comprising: iso-stearic acid, linoleic acid, oleic acid, palmitic acid, myristic acid, dodecanoic acid, isobutyric acid, capric acid, benzoic acid, acetic acid, propionic acid, adipic acid, maleic acid, glutaric acid, fumaric acid, succinic acid, lactic acid, glycolic acid, glutamic acid and combinations thereof. These acids are commonly available and cheap. They allow exact setting of a desired pH value and they are approved as food additives.

[0015] Preferably, the salt comprises a water-soluble mineral salt or metal salt. In particular, the water-soluble mineral salt may be selected from a group comprising a sodium salt, a calcium salt, a potassium salt and combinations thereof. More preferably the salt is NaCl. These salts have been found to be especially suitable to provide the counter ions for the jellifying polymers. Thus, the 3-dimensional network could be established. The salts are available in high quality and quantities. Especially NaCl is available worldwide in food quality. Alternatively or additionally, the salt comprises a metal salt selected from the group consisting of metal cinnamate, metal cycloheptane carboxylate, metal levulinate, metal propanoate, metal stearate and metal undecanoate, and combinations thereof.

[0016] In embodiments the water-soluble mineral salt is dissolved in an amount of 75 % to and 100 % of its maximum solubility in water. This allows homogeneous provision of the required amount of salt with minimal amounts of water and also ensures enough mobile ions are present in a limited volume to transport the electric charges.

[0017] The amount of water-soluble electrolytic agent may be comprised between 0.5 wt. % and 5 wt. % of jellified conductive substrate, preferably between 1.0 wt. % and 3.5 wt. %.

[0018] In a preferred embodiment, the jellified conductive substrate comprises at least 50 % wt. of aerosol generating agent, preferably between 60 and 85 wt. % and the aerosol generating agent is polypropylene glycol, glycerin or combination thereof. An aerosol generating agent of this group is preferred, since it is miscible in water at any ratio and at any temperature within the desired temperature range.

[0019] Preferably, the jellified conductive substrate comprises a flavoring agent and/or a nicotinoid agent.

[0020] In certain embodiments of the invention the aerosol-generating article may comprise a flavoring agent. Such a flavoring agent can preferably alter the sensory or organoleptic character or nature of the mainstream aerosol of the aerosol-generating article. Such flavoring agents can include tobacco but also other sources than tobacco are possible (in addition or as an alternative).

The flavoring agent can be natural or artificial. It is preferably employed as concentrate or flavor samples and/or packages. Exemplary flavoring agents and/or flavors generated by the flavoring agent are selected from a group consisting of plant preferably leaf, flower, berry, fruit, root or nut, such as maple, mint, peppermint, spearmint, wintergreen, nutmeg, clove, lavender, cardamom, cascarilla, cocoa, ginger, cherry, raspberry, strawberry, anise, sage, cinnamon, sandalwood, jasmine, vanillin, green tea, coffee, lemon), artificial flavour (e.g. ethyl vanillin, menthol), animal-origin flavour (e.g. honey), enzymatic or microbiological origin flavour, sweet-like, alcoholic or dessert-like flavour (e.g. chocolate, cookie dough, peanut butter, carrot cake, marshmallow, butter popcorn, prosecco, red wine, rum, jelly bean, Guinness, bourbon, toffee, praline, butter finger, brown bread, etc.) and any combinations thereof. Flavoring agents also can include acidic or basic characteristics (e.g., organic acids, such as levulinic acid, succinic acid, and pyruvic acid). Thus, the taste of the aerosol can be adapted to consumer's requests.

[0021] In possible embodiments, the substrate may comprise tobacco material. The tobacco material may be selected from a group comprising a tobacco leaf, a part of a tobacco leaf, a part of a tobacco plant, a tobacco derivative, tobacco extract, tobacco fine particles, ground tobacco, and combinations thereof.

[0022] Preferably, the jellified conductive substance is contained or embedded in cellulose, preferably natural cellulose fibre to form the body. It has been found, that cellulose can increase the stability of the aerosol-generating article, even at high water content. Cellulose can be present in the form of randomly distributed fibres in the substrate or fibres arranged as a layer adjacent the surface of the substrate or within the substrate such as in the form of a tow, nonwoven, paper and/or mat.

[0023] In an embodiment of the aerosol-generating article, the jellified conductive substance further comprises solid conductive particles, preferably metal and/or carbon. Thus, the conductivity and/or resistance can be adapted to specific needs. In a preferred embodiment, the conductive particles are present at a surface of the aerosol generating article, in particular, at the electrode-interface area(s) in which the electrical contact of the conductive substrate to electrodes of the power supply is established. Thus, suitable energy transfer from the power supply to the aerosol-generating article can be ensured, regardless of the electrical resistance of the jellified conductive substance in other areas. The solid conductive particles may be formed as powder, microspheres, granules, fibres and/or nanotubes.

[0024] Preferably the cast body of the aerosol generating article comprises a cuboid body or layer. Advantages of such a geometry are described with respect to the truncated octahedral pyramid having a base surface formed as a truncated square. However, also for other geometries a cuboid body or layer could be advantageous.

[0025] In a preferred embodiment, the body has a thickness of 1.5 mm or less. The body has preferably a relatively constant thickness allowing it to form a uniform electrolytic space between the electrodes. Thus, quick and homogenous heat distribution throughout the entire volume of the body of the aerosol generating article can be ensured.

[0026] In a preferred embodiment, the aerosol-generating article is configured to generate aerosol upon a current voltage between 1 V and 10 V, preferably between 3 V and 5 V is supplied to the body. Devices providing this voltage are available. Thus, it is possible to use the aerosol generating article also with these known devices. Due to the flexible geometry of the jellified conductive substance, the geometry of the aerosol generating article can easily be adapted to various shapes and/or sizes of receiving cavities of the aerosol generating device.

[0027] Preferably, at least a major part, e.g., more than 65 wt.%, more preferably more than 80 wt. % of the jellified conductive substrate is vaporizable during the aerosol generation in the aerosol generating device. Accordingly, after the vaporizable part of the substrate has been vaporized, there is minimum residue or waste leftover.

[0028] To increase the surface area-to-volume ratio of the aerosol-generating article, in a preferred embodiment the aerosol-generating article may comprise through-holes and/or channels. These through-holes preferably run through the jellified conductive substrate. Channels may be formed at the surface of the substrate such as by grooves running in parallel, discontinuous grooves, a spirally shaped groove, or a grid at the surface of the article formed by intersecting grooves. The holes or channels can be generated during the casting process or added afterwards by drilling, penetrating or hollowing. The higher surface area-to-volume ratio of the aerosol-generating article could increase the amount of aerosol produced in a defined time interval at a given voltage.

[0029] The invention is further directed to a method for producing an aerosol from an aerosol generating article as described above, by supplying electrical voltage by electrodes contacting the body of electrically conductive substrate to provide an aerosol by resistive effect in the substrate. This method allows generating an aerosol, which then can be inhaled by a user.

[0030] In certain embodiments, the method of forming an aerosol can comprise placing an aerosol generating article as otherwise described herein into electrical connection with an electrical power source. For example, the electrical power source can be part of an electronic aerosol generating device. The electrical power source may be a rechargeable battery. An electronic aerosol generating device is adapted to direct the generated aerosol to a mouthpiece where it can be inhaled by a user. Thus, the way to operate the device is very user friendly.

[0031] An electronic aerosol generating device for the article preferably comprises an electronic atomizer adapted to accommodate the aerosol-generating article. Preferably, the electronic atomizer comprises an electri-

cal power source and a housing, wherein the power source comprises electrodes is in contact with the aerosol-generating article when inserted in the housing. The housing preferably comprises a receptacle or receiving cavity for accommodating the aerosol-generating article. When the aerosol-generating article is located in the receiving cavity, the electrical power source preferably can be connected with the aerosol-generating article via the electrodes.

[0032] Preferably, the method steps are intended to be carried out using an aerosol-generating article as described above. The method in particular relates to using such an aerosol-generating article as described above. Conversely, all the features of an aerosol-generating article disclosed in combination with the method steps are also preferred embodiments of the above-described aerosol-generating article individually or in combination with other features. Preferably, the above-mentioned aerosol-generating article comprises at least means allowing the method steps (individually and/or in combination) to be performed by a user.

[0033] The invention further relates to a method for producing an aerosol generating article as aforementioned wherein it comprises:

- producing a mixture of water, a gelling agent, an aerosol forming agent and at least one water-soluble electrolytic agent selected amongst: a salt, an acid or combinations thereof, the amount of water in the substrate representing at least 15 wt. %, preferably more than 20 wt.% of the weight of the substrate,
- pouring the mixture into a mould or layering the mixture onto a plate, allowing the mixture to set into a gel or jelly to form the electrically conductive substrate.

[0034] The step of setting the mixture may include heating, cooling and/or aging the mixture at ambient temperature.

[0035] Preferably another step comprises supplying electrical voltage by electrodes contacting the body to provide an aerosol by resistive effect in the substrate.

[0036] In another preferred embodiment, the method comprises the step of contacting the body to provide an aerosol by resistive effect in the substrate.

[0037] Further advantages, objectives and features of the present invention will be described, by way of example only, in the following description with reference to the appended figure. In the figure, like components in different embodiments can exhibit the same reference symbols.

[0038] The figure show:

Fig. 1 a schematic perspective view of an exemplary embodiment of an aerosol-generating article; and

Fig. 2 another schematic view of the aerosol gener-

ating device.

[0039] Fig. 1 shows a schematic perspective view of an exemplary embodiment of an aerosol-generating article 1. In this embodiment, the article is formed as a truncated octahedral pyramid. Since the electric contact between the power source and the jellified conductive substrate 2 could be established everywhere in or on the aerosol-generating article 1, no contact elements adapted to accommodate the electrodes are needed. The electrodes can be placed at distance one another on the surface of the aerosol-generating article 1 or penetrate in the jellified conductive substrate 2.

[0040] An aerosol-generating article 1 having a geometry of a truncated (n-gonal) pyramid is preferred, since aerosol-generating articles 1 of these geometries can be accommodated in a respective receptacle of the electronic atomizer very easily. Also removing of rests or residues of the aerosol-generating article 1 from the respective receptacle of the electronic atomizer is very easy since an aperture of the receptacle can be wider than a base.

[0041] Providing the aerosol-generating article 1 in form of a truncated (n-gonal) pyramid has the further advantage, that the inner geometry of the receptacle of the electronic atomizer can have the complementary geometry. Thus, the walls and especially the sidewalls of the aerosol-generating articles 1 can be in direct contact to the inner walls of the receptacle of the electronic atomizer. Since the article is relatively soft with a gum or jelly-like texture, it tends to spread on inner walls of the receptacle, even after loosing volume when aerosol is formed, air gaps which poor electrical transfer possible can be prevented. Thus, homogeneous heat transfer and heat generation is possible. Furthermore, continuous flow of the generated aerosol out of the receptacle of the electronic atomizer is possible.

[0042] In fig. 1 the aerosol-generating article 1 has a form of a truncated octahedral pyramid. The base surface 3 differs from a regular octagon, but is a truncated square. The upper surface 4 of the aerosol-generating article 1 is a regular octagon. The corners of the regular octagon of the upper surface 4 and the truncated square of the base surface 3 are connected by edges 6, that form a symmetrical trapezoid with the respective edges of the upper surface 4 and the base surface 3 respectively. For a symmetrical truncated octahedral pyramid, the symmetrical trapezoids are identical. The different appearance of the trapezoids in fig. 1 is caused by the schematic perspective illustration.

Example:

[0043] An aerosol generating substrate A is formed by mixing 64.5 wt. % glycerin, 25 wt. % water, 8 wt. % NaCl, 2 wt. % gellan gum, 0.5 wt. % menthol. The mixture is heated at a temperature of between 85°C and 95°C during 10 minutes and the mixture is poured into a mould

and allowed to cool in a cooling chamber at 10°C during 2 hours.

[0044] An aerosol generating substrate B is formed by mixing 64.5 wt. % glycerin, 29 wt. % water, 6 wt. % stearic acid, 2 wt. % gellan gum, 0.5 wt. % menthol. The mixture is heated at a temperature of between 85°C and 95°C during 20 minutes and the mixture is poured into a mould and allowed to cool in a cooling chamber at 10°C during 2 hours.

[0045] The substrates A and B are removed from the mould and wrapped in a protective paper sheet to form an aerosol generating article. The paper is removed (or at least part of it) before the substrate is inserted in the aerosol generating device to enable the electrodes of the aerosol generating device to contact the substrate.

[0046] Fig. 2 shows another schematic view of the aerosol generating device 1. The reference symbol 12 denotes the mouthpiece and the reference symbol 14 a vapor outlet.

[0047] Inside the housing a control unit and an electrical power source are comprised.

[0048] Reference symbol 20 denotes the receptacle to hold the aerosol generating article 1.

[0049] The reference symbols 16 and 18 denote electrodes. As can be seen, the article 1 is arranged between the electrodes 16 and 18. Furthermore preferably the electrodes 16, 18 are arranged in the receptable.

List of reference symbols

[0050]

- | | |
|----|---------------------------------|
| 1 | aerosol-generating article, |
| 2 | jellified conductive substrate, |
| 3 | base surface, |
| 4 | upper surface, |
| 6 | edge. |
| 12 | mouthpiece |
| 14 | vapor outlet |
| 16 | electrode |
| 18 | electrode |
| 20 | receptable |
| 22 | control unit |
| 24 | electrical power source |

Claims

1. An aerosol generating article (1) configured for providing an aerosol by resistive effect upon being supplied with electrical voltage by electrodes of an aerosol generating device,
characterized in that
the aerosol generating article (1) comprises a jellified electrically conductive substrate cast as a non-flowable body and its composition comprises: water, a gelling agent, an aerosol forming agent and at least one water-soluble electrolytic agent selected

amongst: a salt, an acid or combinations thereof, the amount of water in the substrate represents at least 15 wt. %, preferably more than 20 wt.% of the weight of the substrate.

2. Aerosol generating article (1) according to claim 1, **characterized in that** the resistance of the jellified conductive substrate is less than 2 Ohm, preferably of between 0.5 and 1.5 Ohm, more preferably between 0.75 and 1.25 Ohm, most preferably between 0.9 and 1.1 Ohm.
3. Aerosol generating article (1) according to claim 1 or 2, **characterized in that** it comprises between about 1 and 10 wt. % gelling agent, preferably between about 1 and 5 % wt. gelling agent, more preferably at least between 1.5 and 2.5 % wt., more preferably between 1.75 and 2.25 % wt., most preferably between 1.9 and 2.1 % wt. gelling agent.
4. Aerosol generating article (1) according to any one of claims 1 to 3, **characterized in that** the gelling agent is selected from a group comprising gellan gum, xanthan gum, agar agar and combinations thereof.
5. Aerosol generating article (1) according to any one of claims 1 to 4, **characterized in that** the aerosol generating article (1) comprises an acid selected from a group comprising isostearic acid, linoleic acid, oleic acid, palmitic acid, myristic acid, dodecanoic acid, isobutyric acid, capric acid, benzoic acid, acetic acid, propionic acid, adipic acid, maleic acid, glutaric acid, fumaric acid, succinic acid, lactic acid, glycolic acid, glutamic acid and combinations thereof.
6. Aerosol generating article (1) according to any one of claims 1 to 5, **characterized in that** the salt comprises water-soluble mineral salt or metal salt or a combination thereof.
7. Aerosol generating article (1) according to claim 6, **characterized in that** the water-soluble mineral salt is dissolved in an amount of 75 % to 100 % of its maximum solubility in water.
8. Aerosol generating article (1) according to any one of claims 1 to 7, **characterized in that** the jellified conductive substrate comprises at least 50 % wt. of aerosol generating agent, preferably be-

tween 60 and 85 wt. % and the aerosol generating agent is polypropylene glycol, glycerin or combination thereof.

9. Aerosol generating article (1) according to any one of claim 1 to 8, **characterized in that** the jellified conductive substrate comprises a flavoring agent and/or a nicotinoid agent.
10. Aerosol generating article (1) according to any one of claims 1 to 9, **characterized in that** the jellified conductive substance is contained or embedded in cellulose, preferably natural cellulose fibre to form the body.
11. Aerosol generating article (1) according to any one of claims 1 to 10, **characterized in that** the jellified conductive substance comprises solid conductive particles, preferably metal and/or carbon.
12. Aerosol generating article (1) according to any one of claims 1 to 11, **characterized in that** the body comprises a cuboid body or layer.
13. Aerosol generating article (1) according to claim 12, **characterized in that** the body has a thickness of 1.5 mm or less.
14. Aerosol generating article (1) according to any one of claims 1 to 13, **characterized in that** it is configured to generate aerosol upon a current voltage between 1 V and 10 V, preferably between 3 V and 5 V is supplied to the body.
15. A method for producing an aerosol generating article according to any one of claims 1 to 14, wherein it comprises:
 - producing a mixture of water, a gelling agent, an aerosol forming agent and at least one water-soluble electrolytic agent selected amongst: a salt, an acid or combinations thereof, the amount of water in the substrate representing at least 15 wt. %, preferably more than 20 wt.% of the weight of the substrate,
 - pouring the mixture into a mould or layering the mixture onto a plate,
 - allowing the mixture to set into a gel or jelly to form the electrically conductive substrate.

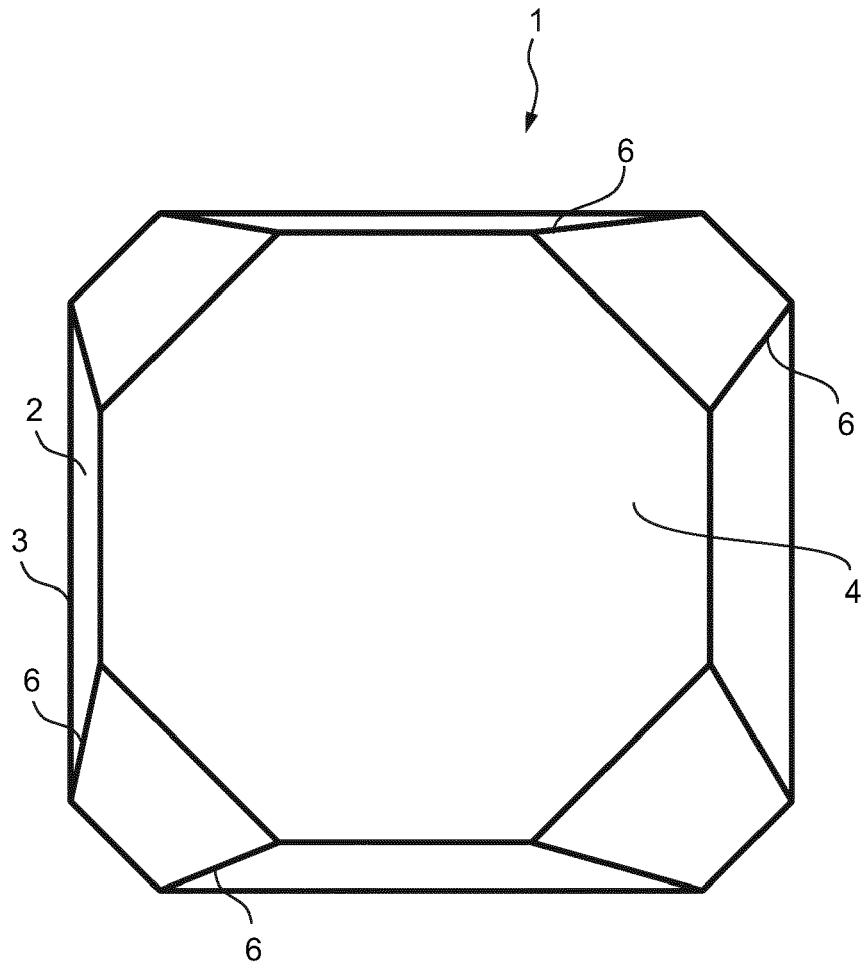


Fig. 1

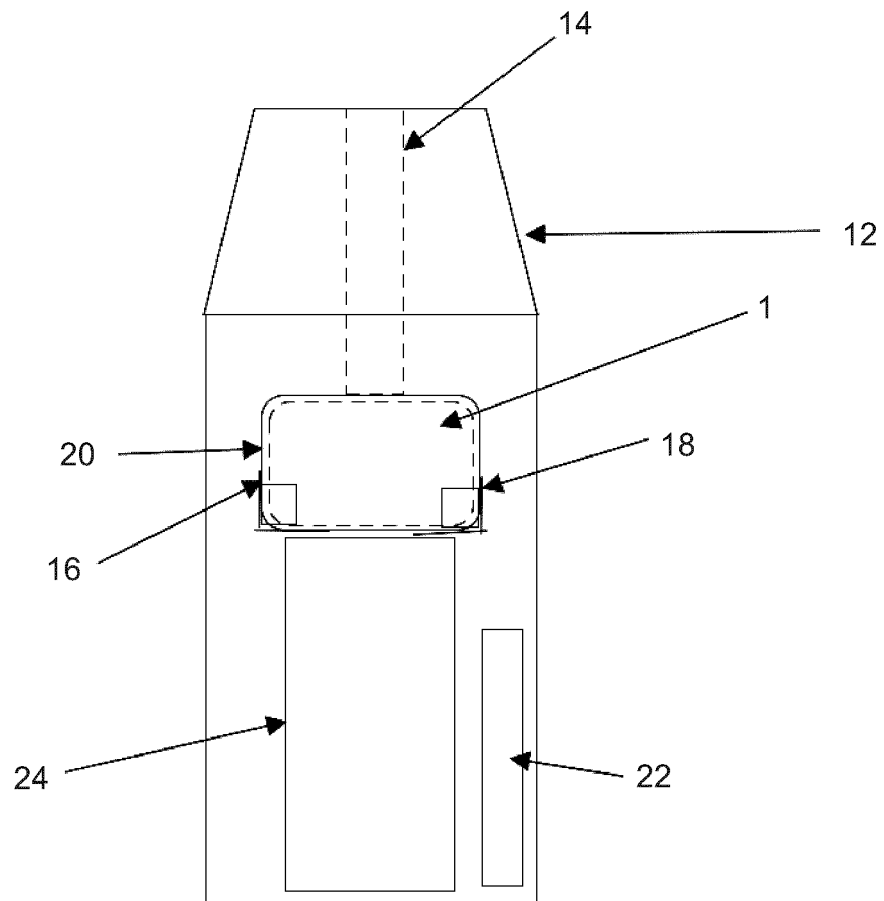


Fig. 2



EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03:82 (P04C01)

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Y	* paragraph [0002] *	11	A24B15/28
A	* paragraph [0007] *	10	A24B15/42
	* paragraph [0014] *		A24F40/20
	* paragraph [0016] *		
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Y	* paragraph [0001] *	11	
A	* paragraph [0033] - paragraph [0034] *	10	
	* paragraph [0036] *		
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 April 2023	Examiner Dimoula, Kerasina
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
ON EUROPEAN PATENT APPLICATION NO.**

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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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