



(51) International Patent Classification:

A24D 3/04 (2006.01)

A24D 3/02 (2006.01)

A24D 1/20 (2020.01)

(21) International Application Number:

PCT/EP2023/058287

(22) International Filing Date:

30 March 2023 (30.03.2023)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

22167184.5

07 April 2022 (07.04.2022)

EP

(71) Applicant: PHILIP MORRIS PRODUCTS S.A.

[CH/CH]; Quai Jeanrenaud 3, 2000 Neuchâtel (CH).

(72) Inventors: BERTOLDO, Massimiliano; Piazza Bel-

gioioso 2, 20121 Milano (IT). MONTANARI, Edoardo;

Piazza Belgioioso 2, 20121 Milano (IT).

(74) Agent: GRÜNECKER PATENT- UND RECHTSAN-

WÄLTE PARTG MBB; Leopoldstrasse 4, 80802

München (DE).

(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,

CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM,

DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG,

KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY,
MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA,
NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO,
RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS,
ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, CV,

GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST,
SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ,
RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ,
DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: AEROSOL-GENERATING ROD PRODUCTION USING A CURVED AND TAPERED CONTACT SURFACE

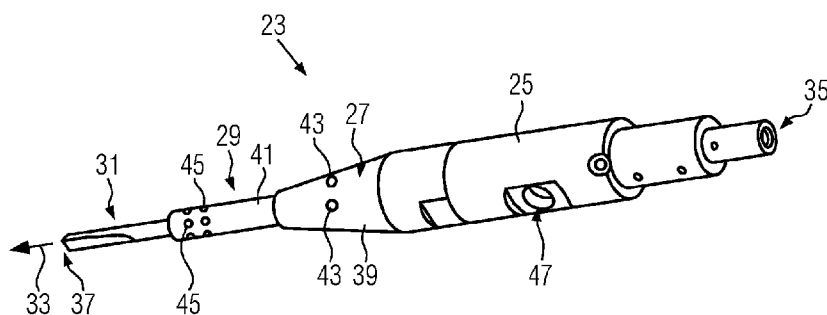


FIG. 2

(57) Abstract: A method for producing an aerosol-generating rod (3) is provided. A web material (19) is conveyed over a contact surface (39) of a contact body (27) such that the web material (19) is in contact with the contact surface (39). The contact surface (39) is curved around an axial direction (33) and tapered along the axial direction (33). A continuous portion of the contact surface (39) spans at least an angle of 90 degrees around the axial direction (33). An additive is dispensed through at least one additive dispensing opening (43) provided in the contact surface (39). The web material (19) is conveyed through a converging device (5) provided downstream of the contact body (27), wherein the web material (19) is formed into a rod (3) within the converging device (5).



Aerosol-generating rod production using a curved and tapered contact surface

The present disclosure relates to the production of aerosol-generating rods using web material.

It is known from practice to form web material within a shaping device to obtain a rod for use in the production of aerosol-generating articles. The rod may incorporate a susceptor to allow generating heat by subjecting the susceptor to an alternating magnetic field. This allows heating the rod from within to cause release of aerosol from the rod.

According to a first aspect of the present invention, there is provided a method for producing an aerosol-generating rod. A web material is conveyed over a contact surface of a contact body such that the web material is in contact with the contact surface. The contact surface is curved around an axial direction. The contact surface is tapered along the axial direction. A continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction. An additive is dispensed through at least one additive dispensing opening provided in the contact surface. The web material is conveyed through a converging device. The converging device is provided downstream of the contact body. The web material is formed into a rod within the converging device.

Since the web material is in contact with the contact surface having the at least one additive dispensing opening, the additive may be dispensed near the web material. A distance between the at least one additive dispensing opening and the web material conveyed over the contact surface may be less than five millimeters, or less than three millimeters, or less than two millimeters, or less than one millimeter, or less than 0.5 millimeters, for example.

The contact surface may be at least partly covered with additive. The additive at least partly covering the contact surface may be additive that has been dispensed through the at least one dispensing opening. Contact between the web material and the contact surface may improve distribution of the additive over the web material.

At least a part of the additive may be applied to the web material directly from the at least one additive dispensing opening. For example, at least a part of the additive may be sprayed directly onto the web material from the at least one additive dispensing opening. The at least one additive dispensing opening may comprise a nozzle spraying the additive onto the web material.

At least a part of the additive dispensed through the at least one additive dispensing opening may be indirectly applied to the web material via the contact surface. At least a part of the additive may be applied from the at least one additive dispensing opening onto the contact surface and from the contact surface to the web material.

The web material may be conveyed over the contact surface along the axial direction. The web material may be conveyed over the contact surface towards the converging device.

Due to contact with the contact surface, the web material may be deformed. Due to contact with the contact surface, at least a portion of the web material may be deformed to align with the shape of the contact surface. Since the contact surface is curved around the axial direction, the web material may deform to be curved around the axial direction when being conveyed over the contact surface. Since the contact surface is tapered along the axial direction, the web material may be deformed to taper along the axial direction when being conveyed over the contact surface.

When the web material is conveyed over the contact surface, lateral sides of the web material may be deformed with respect to a central portion of the web material due to the web material conforming to the shape of the contact surface. The lateral sides of the web material may be deformed towards each other. Deformation of the web material due to contact with the contact surface may reduce a dimension of the web material in a lateral direction perpendicular to the axial direction.

Due to contact with the contact surface, the web material may be pre-formed to facilitate forming the web material into the rod within the converging device. The web material may be deformed by contact with the contact surface in a manner that facilitates entry of the web material into the converging device. Due to contact with the contact surface, a shape of the web material may become more compact.

Since the continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction, the web material may be in contact with the contact surface over at least an angle of 90 degrees around the axial direction. The continuous portion of the contact surface may span an angle of 90 degrees or more around the axial direction. The continuous portion of the contact surface may span an angle of at least 100 degrees, or at least 120 degrees, or at least 140 degrees, or at least 160 degrees, or at least 180 degrees, or at least 200 degrees, or at least 220 degrees, or at least 240 degrees, or at least 260 degrees, or at least 280 degrees, or at least 300 degrees, or at least 320 degrees, or at least 340 degrees around the axial direction. The continuous portion of the contact surface may span an angle of 360 degrees around the axial direction.

At least the entire continuous portion of the contact surface may be curved around the axial direction. At least the entire continuous portion of the contact surface may be continuously curved around the axial direction. At least the continuous portion of the contact surface may have a constant curvature around the axial direction.

At least the entire continuous portion of the contact surface may be tapered along the axial direction. At least the entire continuous portion of the contact surface may have a slope that is constant along the axial direction.

The converging device may comprise a sidewall defining a forming space. The web material may be conveyed through the forming space of the converging device. The web material may be shaped into the rod by engagement with the sidewall of the converging device. The converging device may be funnel-shaped. An open cross-section of the converging device may decrease along the path of the web material.

The web material may be conveyed over the contact surface such that only one side of the web material is in contact with the contact surface. The additive may be applied to only the one side of the web material. The one side of the web material may be an upper side of the web material or a lower side of the web material. The one side of the web material may be a side of the web material that faces away from the sidewall of the converging device when the web material enters the converging device. By applying the additive only to one side of the web material, transfer of additive from the web material to equipment coming in contact with the other side of the web material may be reduced or prevented. For example, contamination of the sidewall of the converging device with additive may be reduced or prevented if additive is applied only to a side of the web material that faces away from the sidewall of the converging device when being conveyed through the converging device.

The contact body may have a conical shape. The web material may be pre-shaped into a conical shape by contact with the contact body to facilitate forming the web material into the rod.

An extension length of the contact surface along the axial direction may be at least one centimeter, or at least two centimeters, or at least three centimeters, or at least four centimeters, or at least five centimeters. An extension length of the contact surface along the axial direction may be less than fifteen centimeters, or less than twelve centimeters, or less than ten centimeters, or less than eight centimeters, or less than six centimeters, or less than five centimeters. An extension length of the contact surface along the axial direction may be between one centimeter and ten centimeters, or between two centimeters and six centimeters, or between three centimeters and five centimeters.

The at least one additive dispensing opening may comprise multiple additive dispensing openings, for example at least two additive dispensing openings, or at least four additive dispensing openings, or at least six additive dispensing openings, or at least ten additive dispensing openings.

The additive may be dispensed through multiple additive dispensing openings. The multiple additive dispensing openings may be provided at different angular positions around the axial direction.

The method may further comprise conveying a susceptor through the converging device. Within the converging device, the web material may be formed around the susceptor into the rod.

The rod may incorporate the susceptor. The rod may centrally incorporate the susceptor. The susceptor may comprise a metal material or be formed of a metal material. The susceptor may be configured to be heated by being subjected to electromagnetic radiation, in particular to alternating electromagnetic radiation. Heating the susceptor may allow heating the rod from within the rod.

5 When the rod is heated, the rod may release aerosol for consumption by a user. The susceptor may be a strand of material. The strand of material may have a circular cross-section, or a rectangular cross-section, or a triangular cross-section, or an elliptical cross-section, for example.

The web material may be deformed due to contact with the contact surface such that the web material is at least partially curved around the susceptor upon entering the converging device.

10 The web material may be pre-formed by contact with the contact surface to reduce the risk of damaging the web material upon contact of the web material with the susceptor. The web material may be pre-formed by contact with the contact surface to facilitate folding of the web material around the susceptor.

The method may further comprise conveying the susceptor through the contact body. The susceptor may be conveyed through the contact body along the axial direction. By conveying the susceptor through the contact body, curving of the web material around the susceptor may be facilitated.

The susceptor may be conveyed through a susceptor guide. The susceptor guide may extend beyond the contact body along the axial direction. The susceptor guide may extend through the contact body. The susceptor guide may comprise a sleeve surrounding the susceptor. The susceptor guide may be provided upstream of the converging device.

The susceptor guide may comprise a susceptor exit opening. The susceptor may leave the susceptor guide through the susceptor exit opening. The susceptor exit opening may be provided upstream of the converging device. The susceptor exit opening may be provided downstream of the contact body. A distance between the contact body and the susceptor exit opening may be at least one centimeter, or least two centimeters, or at least three centimeters, or at least four centimeters, or at least five centimeters, or at least six centimeters, or at least seven centimeters, or at least ten centimeters. A distance between the contact body and the susceptor opening may be less than 30 centimeters, or less than 20 centimeters, or less than 15 centimeters, or less than ten centimeters, or less than five centimeters.

The web material may be conveyed over an additional contact surface. The web material may be in contact with the additional contact surface. The web material may be deformed by contact with the additional contact surface.

An additive may be dispensed through at least one additional additive dispensing opening.

35 The at least one additional additive dispensing opening may be provided in the additional contact

surface. The additive dispensed through the at least one additional additive dispensing opening may be the same kind of additive as the additive dispensed through the at least one additive dispensing opening. The additive dispensed through the at least one additional additive dispensing opening may be a different kind of additive than the additive dispensed through the at least one additive dispensing opening.

The additional contact surface may be provided upstream of the contact surface. The additional contact surface may be provided downstream of the contact surface.

The additional contact surface may be curved around the axial direction. The additional contact surface may be curvature-free along the axial direction. The additional contact surface may be parallel to the axial direction.

The additional contact surface may be defined by an additional contact body. The additional contact body may be a cylindrical body or an elliptical body, for example.

The contact body comprising the contact surface and the additional contact body comprising the additional contact surface may be part of an additive dispensing assembly. The susceptor guide may be part of the additive dispensing assembly. The contact body may be disassembled from the additional contact body. The susceptor guide may be disassembled from the contact body. The susceptor guide may be disassembled from the additional contact body. The contact body, the additional contact body, and the susceptor guide may be disassembled into separate parts. Disassembling the parts may facilitate cleaning the parts. Disassembling the parts may facilitate exchanging one or more of the parts while maintaining the remaining parts.

The method may comprise crimping the web material. Crimping the web material may facilitate deforming the web material. Crimping the web material may comprise forming ridges and grooves in the web material. The ridges and grooves may run in a direction parallel to the direction of conveyance of the web material. Crimping may be carried out at crimping device. The crimping device may be upstream of the contact surface. The crimping device may be downstream of the contact surface.

According to a second aspect of the present invention, there is provided a device for producing an aerosol-generating rod. The device comprises an additive application assembly, a conveyor system, and a converging device. The additive application assembly comprises a contact body defining a contact surface. At least one additive dispensing opening is provided in the contact surface. The conveyor system is configured to convey a web material over the contact surface such that the web material is in contact with the contact surface. The converging device is provided downstream of the additive application assembly. The additive application assembly comprises a susceptor guide configured to guide a susceptor. The susceptor extends beyond the contact body towards the converging device. The conveyor system is configured to convey the

web material through the converging device to form the web material within the converging device around the susceptor into the rod.

Since the susceptor guide extends beyond the contact body towards the converging device, the susceptor guide may guide the susceptor between the contact body and the converging device. The susceptor guide may prevent the web material from coming into contact with the susceptor directly after an additive has been applied to the web material through the at least one additive dispensing opening. The susceptor guide may prevent excessive amounts of additive from sticking to the susceptor.

The contact surface may be curved around an axial direction.

The at least one additive-dispensing opening may comprise multiple additive dispensing openings provided at different angular positions around the axial direction.

The contact surface may be tapered along the axial direction.

A continuous portion of the contact surface may span at least an angle of 90 degrees around the axial direction.

The conveyor system may be configured to convey the web material over the contact surface such that only one side of the web material is in contact with the contact surface.

The contact body may have a conical shape.

The susceptor guide may comprise a sleeve through which the susceptor is conveyed. The sleeve may extend along the axial direction. The sleeve may protrude from a downstream side of the contact body.

The conveyor system may be configured to convey the susceptor. The conveyor system may be configured to convey the susceptor through the susceptor guide. The conveyor system may be configured to convey the susceptor through the converging device. The conveyor system may be configured to convey the susceptor through an opening of the contact body. The conveyor system may be configured to convey the susceptor through the contact body.

The susceptor guide may extend at least partially through the contact body. The susceptor guide may extend fully through the contact body.

The susceptor guide may comprise a susceptor exit opening. The susceptor exit opening may be provided upstream of the converging device. The susceptor exit opening may be provided downstream of the contact body. The susceptor exit opening may be provided between the contact body and the converging device. The susceptor exit opening may face into the axial direction. The susceptor exit opening may be defined by a downstream end of the susceptor guide.

The contact body and the susceptor guide may be combined, in particular detachably combined.

The additive application assembly may comprise an additional contact body. The additional contact body may comprise an additional contact surface. The conveyor system may be configured to convey the web material over the additional contact surface. The conveyor system may be configured to convey the web material in contact with the additional contact surface.

5 At least one additional additive dispensing opening may be provided in the additional contact surface.

The additional contact surface may be provided downstream of the contact surface.

The additional contact body may be a cylindrical contact body.

The contact body and the additional contact body may be detachably combined.

10 The additional contact body and the susceptor guide may be detachably combined.

The device may further comprise a crimping device configured to crimp the web material. The crimping device may be provided upstream of the additive application assembly. The crimping device may be provided downstream of the additive application assembly.

The device may further comprise an additive reservoir. The at least one additive dispensing opening may be connected to the additive reservoir. The at least one additive dispensing opening may be configured to dispense additive from the additive reservoir.

15 The at least one additional additive dispensing opening may be connected to the additive reservoir, or to an additional additive reservoir. The at least one additional additive dispensing opening may be configured to dispense additive from the additive reservoir, or from the additional additive reservoir.

20 According to a third aspect of the present invention, there is provided a use of a contact surface that has at least one additive dispensing opening provided therein in a process for manufacturing an aerosol-generating rod to apply an additive onto a web material and to pre-shape the web material before the web material enters a converging device where the web material is shaped into the rod. The contact surface is curved around an axial direction. The contact surface is tapered along the axial direction. A continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction.

25 According to a fourth aspect of the present invention, there is provided a device for producing an aerosol-generating rod. The device comprises a contact body and a conveyor system. The contact body defines a contact surface. At least one additive dispensing opening is provided in the contact surface. The conveyor system is configured to convey a web material along an axial direction over the contact surface such that the web material is in contact with the contact surface. An extension dimension of the contact surface along the axial direction is less than 10 millimeters.

30

The narrow configuration of the contact surface with the extension dimension of the contact surface along the axial direction being less than 10 millimeters may reduce contamination of the contact body with additive dispensed through the at least one additive dispensing opening. Further, the narrow contact surface may reduce friction between the web material and the contact surface.

The extension dimension of the contact surface along the axial direction may be between one millimeter and ten millimeters, or between two millimeters and eight millimeters, or between two millimeters and six millimeters, or between three millimeters and four millimeters.

An extension dimension of the contact surface in a lateral direction perpendicular to the axial direction may be between 30 millimeters and 200 millimeters, or between 50 millimeters and 180 millimeters, or between 70 millimeters and 160 millimeters, for example.

The contact surface may be flat. The contact surface may be curvature-free in a lateral direction perpendicular to the axial direction. The contact surface may be a horizontal contact surface.

An opening direction of the at least one additive dispensing opening may be perpendicular to the axial direction.

The at least one additive dispensing opening may comprise a plurality of additive dispensing openings. The additive dispensing openings may be provided at different positions along a lateral direction perpendicular to the axial direction. The additive dispensing openings may be provided in a line. The line may extend perpendicular to the axial direction. The additive dispensing openings may be evenly spaced.

The device may further comprise a converging device. The converging device may be provided downstream of the contact body. The conveyor system may be configured to convey the web material through the converging device to form the web material within the converging device into the rod.

The conveyor system may be configured to convey a susceptor through the converging device. Within the converging device, the web material may be formed into a rod around the susceptor.

The device may further comprise an adjustment assembly. The adjustment assembly may be configured to adjust at least one of a position and an orientation of the contact body. By adjusting at least one of the position and the orientation of the contact body, contact between the web material and the contact surface may be optimized. The contact body may be rearranged using the adjustment assembly to optimize a contact pressure between the web material and the contact surface. The contact body may be rearranged with the adjustment assembly to optimize

at least one of the position and the orientation of the contact body with respect to a path along which the web material is conveyed.

The adjustment assembly may be configured to move the contact body in a translational motion. The adjustment assembly may be configured to move the contact body in a rotational motion. The adjustment assembly may be configured to move the contact body in a translational motion and configured to move the contact body in a rotational motion.

An additive supply path may be provided in the contact body. The at least one additive dispensing opening may be connected to the additive supply path. Each additive dispensing opening may be connected to the additive supply path. The at least one additive dispensing opening may be connected to the supply path by at least one branch path branching from the additive supply path.

The additive supply path may be a hollowed portion of the contact body. The additive supply path may be configured to guide additive. The additive supply path may be configured to guide additive at least partially to the at least one additive dispensing opening.

The additive supply path may extend within the contact body in a lateral direction. The lateral direction may be perpendicular to the axial direction. The lateral direction may be parallel to the contact surface.

The additive supply path may extend within the contact body along the lateral direction over at least 30 percent, or at least 40 percent, or at least 50 percent, or at least 60 percent, or at least 70 percent, or at least 80 percent of an extension dimension of the contact body in the lateral direction.

The additive supply path may end in a cleaning opening provided in an outer surface of the contact body. The cleaning opening may face in the lateral direction. The cleaning opening may be configured for insertion of a brush or the like.

The additive supply path may extend within the contact body in a straight manner. The additive supply path may extend within the contact body in a straight manner along the lateral direction. A straight extension of the additive supply path may facilitate cleaning the additive supply path, for example by inserting a brush through the cleaning opening.

The additive supply path may be connected to an additive supply opening provided in an outer surface of the contact body. The additive supply opening may be configured to connect to an external additive supply line. The external additive supply line may be connected to an additive tank.

A diameter of the additive supply path may be between three millimeters and 20 millimeters, or between three millimeters and ten millimeters, or between five millimeters and eight millimeters, for example.

The additive supply path may have a circular cross-section. The additive supply path may have a rectangular cross-section. The additive supply path may have an elliptical cross-section. The additive supply path may have a triangular cross-section. The additive supply path may have a polygonic cross-section.

5 The contact body may comprise a slanted surface adjoining the contact surface along the axial direction. The slanted surface may be inclined with respect to the contact surface by between 10 degrees and 80 degrees around a lateral axis perpendicular to the axial direction.

According to a fifth aspect of the present invention, there is provided a method for producing an aerosol-generating rod. A web material is conveyed along an axial direction over a flat contact surface. The flat contact surface is defined by a contact body. The web material is in contact with the contact surface. An additive is dispensed onto the web material through at least one additive dispensing opening provided in the contact surface. The web material is conveyed over a slanted surface of the contact body. The slanted surface adjoins the contact surface along the axial direction. The slanted surface is inclined with respect to the contact surface by between 10 degrees and 80 degrees around a lateral axis perpendicular to the axial direction.

The slanted surface may be inclined with respect to the contact surface by between 10 degrees and 60 degrees, or by between 10 degrees and 50 degrees, or by between 20 degrees and 40 degrees, or by between 25 degrees and 35 degrees, or by about 30 degrees around the lateral axis.

20 The lateral axis may be parallel to the contact surface. The lateral axis may extend along a border between the contact surface and the slanted surface. The lateral axis may define a border between the contact surface and the slanted surface.

The slanted surface may be inclined with respect to the contact surface in a direction away from the web material.

25 The contact surface may be upwardly facing. The slanted surface may be downwardly inclined along the axial direction.

The slanted surface may be a flat surface.

The slanted surface may extend beyond the contact surface along the axial direction by at least three millimeters, or at least five millimeters, or at least six millimeters, or at least seven millimeters, or at least eight millimeters. The slanted surface may extend beyond the contact surface along the axial direction by less 50 millimeters, or less than 30 millimeters, or less than 25 millimeters, or less than 20 millimeters, or less than ten millimeters, or less than eight millimeters.

The web material may be conveyed over the slanted surface without contact with the slanted surface. Lack of contact between the web material and the slanted surface may reduce contamination of the contact body with additive downstream of the contact surface.

Since the inclination of the slanted surface with respect to the contact surface is below 90 degrees, the contact body may extend along the axial direction further than the contact surface. This may facilitate design of the contact body, in particular with respect to providing one or more additive supply lines within the contact body.

5 An extension dimension of the contact surface along the axial direction may be less than 10 millimeters.

An opening direction of the at least one additive dispensing opening may be perpendicular to the axial direction.

10 The web material may be conveyed through a converging device provided downstream of the contact body to form the web material into the rod.

In any one of the described aspects, the contact surface may be positioned less than one meter, or less than 60 centimeters, or less than 40 centimeters from the converging device. The contact surface may be positioned at least five centimeters, or between five centimeters and 20 centimeters, from the converging device. Providing the contact surface within such close proximity
15 of the converging device may reduce the amount of time the additive is on the web material before the web material is formed into a rod. This may help reduce the amount of additive which may be lost from the web material during conveyance of the web material.

In any one of the described aspects, the additive may comprise aerosol-generating substances, such as one or more of glycerin, glycerol, and propylene glycol, for example. The
20 additive may comprise one or more flavorants, such as menthol, spearmint, peppermint, eucalyptus, vanilla, cocoa, chocolate, coffee, tea, spices (such as cinnamon, clove, and ginger), fruit flavorants, and combinations thereof. The additive may comprise nicotine.

The additive may be dispensed as a liquid or as a gel, for example.

Preferably, the additive comprises menthol. The additive may comprise menthol at a mass
25 percentage of at least 40 percent, or of at least 50 percent, or of at least 70 percent, or of at least 80 percent, or of at least 90 percent, or of at least 95 percent. The additive may be pure menthol. Menthol may act as an aerosol-generating substance upon heating the rod. Menthol has a strong physical consistency and may be applied to the web material in a reproducible manner.

In any one of the described aspects, the web material may be a cast of a slurry containing
30 herbaceous material or of a paste containing herbaceous material. The web material may be a cast leaf material, in particular a tobacco cast leaf material. The slurry or the paste may comprise one or more species of herbaceous material. Casting herbaceous material as a web allows the herbaceous material to be continuously supplied to the production process.

The web material may comprise cut or ground herbaceous material. The cut or ground herbaceous material may, for example, comprise particulate herbaceous material having a particle size between 40 microns and 500 microns.

The herbaceous material may comprise homogenised plant material.

5 The herbaceous material may, for example, comprise tobacco material, or clove material, or a mixture of clove material and tobacco material. Tobacco material, or clove material, or a mixture of clove material and tobacco material may, but do not have to, account for 100 percent of the herbaceous material. The herbaceous material may comprise no tobacco particles and 100 percent clove particles, based on the dry weight of the herbaceous material. The herbaceous material may comprise between 10 percent and 60 percent by weight clove particles and between 40 percent and 90 percent by weight tobacco particles, more preferably between 30 percent and 40 percent by weight clove particles and between 70 percent and 60 percent by weight tobacco particles, based on the dry weight of the herbaceous material. The web material may, for example, comprise a total content of between 40 percent and 90 percent by weight tobacco particles and a total content of between 10 percent and 60 percent by weight clove particles, based on dry weight of the web material.

20 The web material may, for example, comprise one or more of eugenol, eugenol-acetate, and beta-caryophyllene. In particular, the web material may comprise at least 125 micrograms of eugenol per gram of the web material, on a dry weight basis; at least 125 micrograms of eugenol-acetate per gram of the web material, on a dry weight basis; and at least 1 microgram of beta-caryophyllene per gram of the web material, on a dry weight basis.

The web material may comprise at least one of cellulose fibers and glycerin. Cellulose fibers may strengthen the web material and make it more resistant to breaking or tearing. Glycerin may facilitate the production of aerosol upon heating the web material.

25 The web material may have a thickness of less than 1 millimeter, or of less than 0.5 millimeter, or of less than 0.2 millimeter, or of less than 0.1 millimeter, or of less than 0.05 millimeter. The web material may have a thickness of at least 0.001 millimeter, or of at least 0.01 millimeter, or of at least 0.1 millimeter. Web material having a comparatively low thickness may be easier to shape into the rod shape. Web material having a comparatively high thickness may be less likely to be torn or damaged upon dispensing the additive onto the web material.

30 The device for producing an aerosol-generating rod according to the second aspect may be adapted to be used in the method for producing an aerosol-generating rod according to the first aspect or with the use according to the third aspect. The method for producing an aerosol-generating rod according to the first aspect or the use according to the third aspect may comprise using the device for producing an aerosol-generating rod according to the second aspect.

The device for producing an aerosol-generating rod according to the fourth aspect may be adapted to be used in the method for producing an aerosol-generating rod according to the fifth aspect. The method for producing an aerosol-generating rod according to the fifth aspect may comprise using the device for producing an aerosol-generating rod according to the fourth aspect.

5 The invention is defined in the claims. However, below there is provided a non-exhaustive list of non-limiting examples. Any one or more of the features of these examples may be combined with any one or more features of another example, embodiment, or aspect described herein.

Example Ex1: Method for producing an aerosol-generating rod, comprising:

conveying a web material over a contact surface of a contact body such that the web
10 material is in contact with the contact surface, wherein the contact surface is curved around an axial direction and tapered along the axial direction, wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction;

dispensing an additive through at least one additive dispensing opening provided in the contact surface; and

15 conveying the web material through a converging device provided downstream of the contact body, wherein the web material is formed into a rod within the converging device.

Example Ex2: Method according to Example Ex1, wherein lateral sides of the web material are deformed with respect to a central portion of the web material due to the web material conforming to the shape of the contact surface when the web material is conveyed over the contact
20 surface.

Example Ex3: Method according to Example Ex1 or Ex2, wherein the web material is conveyed over the contact surface such that only one side of the web material is in contact with the contact surface.

Example Ex4: Method according to any one of Examples Ex1 to Ex3, wherein the contact
25 body has a conical shape.

Example Ex5: Method according to any one of Examples Ex1 to Ex4, wherein the additive is dispensed through multiple additive dispensing openings provided at different angular positions around the axial direction.

Example Ex6: Method according to any one of Examples Ex1 to Ex5, further comprising
30 conveying a susceptor through the converging device, wherein the web material is formed around the susceptor into the rod within the converging device.

Example Ex7: Method according to Example Ex6, further comprising conveying a susceptor through the contact body.

Example Ex8: Method according to Example Ex6 or Ex7, wherein the susceptor is conveyed through a susceptor guide, wherein the susceptor guide extends beyond the contact body along the axial direction.

Example Ex9: Method according to Example Ex8, wherein the susceptor leaves the susceptor guide through a susceptor exit opening, wherein the susceptor exit opening is at least one of provided upstream of the converging device and provided downstream of the contact body.

Example Ex10: Method according to any one of Examples Ex 1 to Ex9, further comprising conveying the web material over an additional contact surface.

Example Ex11: Method according to Example Ex10, further comprising dispensing an additive through at least one additional additive dispensing opening provided in the additional contact surface.

Example Ex12: Method according to Example Ex10 or Ex11, wherein the additional contact surface is provided downstream of the contact surface.

Example Ex13: Method according to any one of Examples Ex10 to Ex12, wherein the additional contact surface is defined by an additional contact body, wherein the additional contact body may be a cylindrical body.

Example Ex14: Method according to Example Ex13, further comprising disassembling the contact body from the additional contact body.

Example Ex15: Method according to any one of Examples Ex1 to Ex14, further comprising crimping the web material.

Example Ex16: Device for producing an aerosol-generating rod, comprising:
an additive application assembly comprising a contact body defining a contact surface, wherein at least one additive dispensing opening is provided in the contact surface;

a conveyor system configured to convey a web material over the contact surface such that the web material is in contact with the contact surface; and

a converging device provided downstream of the additive application assembly;
wherein the additive application assembly comprises a susceptor guide configured to guide a susceptor;

wherein the susceptor guide extends beyond the contact body towards the converging device; and

wherein the conveyor system is configured to convey the web material through the converging device to form the web material within the converging device around the susceptor into the rod.

Example Ex17: Device according to Example Ex16, wherein the contact surface is curved around an axial direction.

Example Ex18: Device according to Example Ex17, wherein the at least one additive dispensing opening comprises multiple additive dispensing openings provided at different angular positions around the axial direction.

5 Example Ex19: Device according to Example Ex17 or Ex18, wherein the contact surface is tapered along the axial direction.

Example Ex20: Device according to any one of Examples Ex17 to Ex19, wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction.

10 Example Ex21: Device according to any one of Examples Ex16 to Ex20, wherein the conveyor system is configured to convey the web material over the contact surface such that only one side of the web material is in contact with the contact surface.

Example Ex22: Device according to any one of Examples Ex16 to Ex21, wherein the contact body has a conical shape.

15 Example Ex23: Device according to any one of Examples Ex16 to Ex22, wherein the susceptor guide extends at least partially through the contact body.

Example Ex24: Device according to any one of Examples Ex16 to Ex23, wherein the susceptor guide comprises a susceptor exit opening, wherein the susceptor exit opening is at least one of provided upstream of the converging device and provided downstream of the contact body.

20 Example Ex25: Device according to any one of Examples Ex16 to Ex24, wherein the additive application assembly comprises an additional contact body, wherein the additional contact body comprises an additional contact surface, and wherein the conveyor system is configured to convey the web material over the additional contact surface.

Example Ex26: Device according to Example Ex25, wherein at least one additional additive dispensing opening is provided in the additional contact surface.

25 Example Ex27: Device according to Example Ex25 or Ex26, wherein the additional contact surface is provided downstream of the contact surface.

Example Ex28: Device according to any one of Examples Ex25 to Ex27, wherein the additional contact body is a cylindrical contact body.

30 Example Ex29: Device according to any one of Examples Ex25 to Ex28, wherein the contact body and the additional contact body are detachably combined.

Example Ex30: Device according to any one of Examples Ex16 to Ex29, further comprising a crimping device configured to crimp the web material.

Example Ex31: Device according to Example Ex31, wherein the crimping device is provided upstream of the additive application device.

Example Ex32: Use of a contact surface that has at least one additive dispensing opening provided therein in a process for manufacturing an aerosol-generating rod to apply an additive onto a web material and to pre-shape the web material before the web material enters a converging device where the web material is shaped into the rod, wherein the contact surface is curved around an axial direction and tapered along the axial direction, and wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction.

Example Ex33: Device for producing an aerosol-generating rod, comprising:

a contact body defining a contact surface, wherein at least one additive dispensing opening is provided in the contact surface; and

a conveyor system configured to convey a web material along an axial direction over the contact surface such that the web material is in contact with the contact surface;

wherein an extension dimension of the contact surface along the axial direction is less than 10 millimeters.

Example Ex34: Device according to Example Ex33, wherein the contact surface is curvature-free in a lateral direction perpendicular to the axial direction, and in particular the contact surface is flat.

Example Ex35: Device according to Example Ex33 or Ex34, wherein an opening direction of the at least one additive dispensing opening is perpendicular to the axial direction.

Example Ex36: Device according to any one of Examples Ex33 to Ex35, further comprising a converging device provided downstream of the contact body, wherein the conveyor system is configured to convey the web material through the converging device to form the web material within the converging device into the rod.

Example Ex37: Device according to any one of Examples Ex33 to Ex36, further comprising an adjustment assembly configured to adjust at least one of a position and an orientation of the contact body.

Example Ex38: Device according to any one of Examples Ex33 to Ex37, wherein an additive supply path is provided in the contact body, wherein the at least one additive dispensing opening is connected to the additive supply path.

Example Ex39: Device according to Example Ex38, wherein the additive supply path extends within the contact body in a lateral direction perpendicular to the axial direction.

Example Ex40: Device according to Example Ex38 or Ex39, wherein the additive supply path ends in a cleaning opening provided in an outer surface of the contact body.

Example Ex41: Device according to any one of Examples Ex38 to Ex40, wherein the additive supply path extends within the contact body in a straight manner.

Example Ex42: Device according to any one of Examples Ex33 to Ex41, wherein the contact body comprises a slanted surface adjoining the contact surface along the axial direction, wherein the slanted surface is inclined with respect to the contact surface by between 10 degrees and 80 degrees around a lateral axis perpendicular to the axial direction.

5 Example Ex43: Method for producing an aerosol-generating rod, comprising:
conveying a web material along an axial direction over a flat contact surface defined by a contact body, wherein the web material is in contact with the contact surface;

dispensing an additive onto the web material through at least one additive dispensing opening provided in the contact surface; and

10 conveying the web material over a slanted surface of the contact body, wherein the slanted surface adjoins the contact surface along the axial direction, and wherein the slanted surface is inclined with respect to the contact surface by between 10 degrees and 80 degrees around a lateral axis perpendicular to the axial direction.

Example Ex44: Method according to Example Ex43, wherein an extension dimension of the contact surface along the axial direction is less than 10 millimeters.

Example Ex45: Method according to Example Ex43 or Ex44, wherein an opening direction of the at least one additive dispensing opening is perpendicular to the axial direction.

Example Ex46: Method according to any one of Examples Ex43 to Ex45, further comprising conveying the web material through a converging device provided downstream of the contact body to form the web material into the rod.

Embodiments will now be further described with reference to the figures in which:

Fig. 1 shows a schematic side view of a device for producing an aerosol-generating rod according to an embodiment with a contact body having a curved contact surface;

Fig. 2 shows a schematic perspective view of an additive application assembly according to an embodiment with the contact body having a curved contact surface;

Fig. 3 shows a sectional view of an additive application assembly according to an embodiment with the contact body having a curved contact surface;

Fig. 4 shows a schematic view of a device for producing an aerosol-generating rod according to an embodiment with a contact body having a flat contact surface;

Fig. 5 shows a contact body according to an embodiment with a flat contact surface in a perspective view from above;

Fig. 6 shows a contact body according to an embodiment with a flat contact surface in a perspective view from below;

Fig. 7 shows a contact body according to an embodiment with a flat contact surface in a sectional view with the sectional plane perpendicular to the axial direction; and

Fig. 8 shows a contact body according to an embodiment with a flat contact surface in a side view with a viewing direction along the lateral direction.

Fig. 1 shows a schematic side of a device 1 for producing an aerosol-generating rod 3. The device 1 comprises a funnel-shaped converging device 5. The converging device 5 comprises a sidewall 7 defining a forming space. The converging device 5 extends from an entry opening 9 of the converging device 5 to an exit opening 11 of the converging device 5.

The device 1 comprises a conveyor system 13 with a web conveyor 15 and a susceptor conveyor 17. The web conveyor 15 is configured to convey a web material 19 through the converging device 5. The susceptor conveyor is configured to convey a susceptor 21 through the converging device 5. The web material 19 and the susceptor 21 are conveyed through the converging device 5 from the entry opening 9 of the converging device 5 to the exit opening 11 of the converging device 5. Within the forming space of the converging device 5, the web material 19 is compressed into a rod shape around the susceptor 21. At the exit opening 11, a rod 3 in which the web material 19 circumferentially surrounds the susceptor 21 leaves the forming space.

Upstream of the converging device 5, the web material 19 and the susceptor 21 pass an additive application assembly 23. Fig. 2 shows a schematic perspective view of the additive application assembly 23 according to an embodiment. Fig. 3 shows the additive application assembly 23 in a sectional view. The additive application assembly 23 shown in Figs. 2 and 3 may be used in the device 1 shown in Fig. 1.

The additive application assembly 23 comprises a main body 25, a contact body 27, an additional contact body 29, and a susceptor guide 31. The susceptor guide 31 extends through the main body 25, the contact body 27, and the additional contact body 29 along an axial direction 33. The susceptor guide 31 is a sleeve-like element through which the susceptor 21 is conveyed along the axial direction 33. The susceptor 21 enters the susceptor guide 31 through a susceptor entry opening 35 of the susceptor guide 31 and exits the susceptor guide 31 through a susceptor exit opening 37 of the susceptor guide 31. The susceptor exit opening 37 is provided downstream of the main body 25, the contact body 27, and the additional contact body 29.

The contact body 27 comprises a contact surface 39. The additional contact body 29 comprises an additional contact surface 41. The web material 19 is conveyed over the contact surface 39 and the additional contact surface 41 essentially along the axial direction 33. The web material 19 is in contact with the contact surface 39 and the additional contact surface 41.

Additive dispensing openings 43 are provided in the contact surface 39. Additional additive dispensing openings 45 are provided in the additional contact surface 41. Additive is dispensed through the additive dispensing openings 43 and through the additional additive dispensing

openings 45. The additive is dispensed onto the web material 19, while the web material 19 is conveyed over the contact surface 39 and the additional contact surface 41.

The contact body 27 has a conical shape. The contact surface 39 is formed by an outer surface of the contact body 27. The contact surface 39 is curved around the axial direction 33 and tapers along the axial direction 33.

The additional contact body 29 has a cylindrical shape. The additional contact surface 41 is formed by an outer surface of the contact body 29. The additional contact surface 41 is curved around the axial direction 33.

When being conveyed over the contact surface 39 and the additional contact surface 41, the web material 19 is deformed due to contact with the contact surface 39 and the additional contact surface 41. This causes lateral sides of the web material 19 to be deformed downwards with respect to a central portion of the web material 19, so that the web material 19 is at least partially curved around the susceptor 21. Thus, the web material 19 is pre-formed before entering the converging device 5.

The main body 25 comprises an additive supply opening 47. An external additive supply may be connected to the additive supply opening 47 to provide additive to be dispensed through the additive dispensing openings 43 and the additional additive dispensing openings 45. In particular, the additive supply opening 47 may be connected to an additive tank. A pump may be provided to generate pressure for dispensing the additive through the additive dispensing openings 43 and the additional additive dispensing openings 45.

The main body 25, the contact body 27, the additional contact body 29, and the susceptor guide 31 may be disassembled for cleaning. For example, threaded connections may be used to connect the main body 25, the contact body 27, the additional contact body 29, and the susceptor guide 31 to each other in a reversible manner.

Fig. 4 shows another embodiment of a device 1 for producing aerosol-generating rods 3. The converging device 5 and the transport system 13 may be the same as in the embodiment of Fig. 1. In the embodiment of Fig. 4, the susceptor 21 is conveyed by the susceptor conveyor 17 without a susceptor guide. However, a susceptor guide could be provided in the embodiment of Fig. 4 as well. The embodiment of Fig. 4 has an additive application assembly 51 that is different from the additive application assembly 23 of the embodiments of Figs. 1 to 3. The additive application assembly 51 is provided upstream of the converging device 5 in the path of the web material 19. The additive application assembly 51 comprises a contact body 53. The contact body 53 comprises a contact surface 55. The web material 19 is conveyed over the contact surface 55 along an axial direction 57. The web material 19 is in contact with the contact surface 55.

Fig. 5 shows a perspective view of the contact body 53 from above. The contact surface 55 is flat. The contact surface 55 is parallel to the axial direction 57. The contact surface 55 extends in the axial direction 57 and in a lateral direction 59 perpendicular to the axial direction 57.

Additive dispensing openings 61 are provided in the contact surface 55. Additive is dispensed through additive dispensing openings 55 onto the web material 19. An extension dimension 63 of the contact surface 55 along the axial direction 57 is less than ten millimeters, for example between three and five millimeters.

The contact body 53 comprises a slanted surface 65 adjoining the contact surface 55 along the axial direction 57. A border between the contact surface 55 and the slanted surface 65 is defined by a lateral axis 67. The slanted surface 65 is a flat surface that is inclined away from the web material 19 by between 10 degrees and 80 degrees around the lateral axis 67. In the illustrated embodiment, the slanted surface 65 is inclined with respect to the contact surface 55 by about 30 degrees around the lateral axis 67. The inclination of the slanted surface 65 may prevent or reduce contact between the web material 19 and the slanted surface 65, thereby reducing undesired contamination of the contact body 53 with additive.

Fig. 6 shows a bottom perspective view of the contact body 53. The contact body 53 comprises an additive supply opening 69 provided in a lower surface of the contact body 53 opposite the contact surface 55. A cleaning opening 71 is provided in a lateral surface of the contact body 53.

Fig. 7 shows a sectional view through the contact body 53 with the sectional plane being perpendicular to the axial direction 57. An additive supply path 73 extends within the contact body 53 along the lateral direction 59. The additive supply path 73 has a connection with the additive supply opening 69 allowing the additive supply path 73 to be supplied with additive. The additive supply path 73 is connected to the additive dispensing openings 61 to provide additive to the additive dispensing openings 61. In the illustrated embodiment, the additive dispensing openings 61 directly branch from the additive supply path 73. Alternatively, branch paths could be provided to connect the additive supply path 73 with the additive dispensing openings 61.

The additive supply path 73 ends in the cleaning opening 71. The additive supply path 73 extends within the contact body 53 in a straight manner along the lateral direction 59. A cleaning device, such as a brush, may enter the additive supply path 73 through the cleaning opening 71 to clean an inside of the contact body 51. In use, the cleaning opening 71 may be closed with a stopper.

Fig. 8 shows a sectional view through the contact body 53 with the sectional plane being perpendicular to the lateral direction 59.

As shown in Fig. 4, an additive valve 75 is connected to the additive supply opening 69. The additive valve 75 is connected to a pump supplying the additive from an additive tank.

As also shown in Fig. 4, the device 1 comprises an adjustment unit 77 for adjusting a position and an orientation of the contact body 53 with respect to the transport path of the web material 19. The adjustment unit 77 comprises a clamp 79 at which the contact body 53 is attached. The clamp 79 is rotatably mounted at a pole 81. The pole 81 is attached to a slider 83 via a lever 85. The lever 85 may be rotated with respect to the slider 83. The slider 83 is slidably mounted on a guide rail 85. The positioning and orientation of the contact body 53 with respect to the path of the web material 19 may be adjusted by any one or more of a rotation of the clamp 79 with respect to the pole 81, a rotation of the lever 85 with respect to the slider 83, and a sliding motion of the slider 83 along the guide rail 85.

For the purpose of the present description and of the appended claims, except where otherwise indicated, all numbers expressing amounts, quantities, percentages, and so forth, are to be understood as being modified in all instances by the term "about". Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein. In this context, therefore, a number A is understood as $A \pm \{10 \text{ percent}\}$ of A. Within this context, a number A may be considered to include numerical values that are within general standard error for the measurement of the property that the number A modifies. The number A, in some instances as used in the appended claims, may deviate by the percentages enumerated above provided that the amount by which A deviates does not materially affect the basic and novel characteristic(s) of the claimed invention. Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein.

Claims

1. Method for producing an aerosol-generating rod, comprising:
conveying a web material over a contact surface of a contact body such that the web material is in contact with the contact surface, wherein the contact surface is curved around an axial direction and tapered along the axial direction, wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction;
dispensing an additive through at least one additive dispensing opening provided in the contact surface; and
conveying the web material through a converging device provided downstream of the contact body, wherein the web material is formed into a rod within the converging device.
2. Method according to claim 1, wherein lateral sides of the web material are deformed with respect to a central portion of the web material due to the web material conforming to the shape of the contact surface when the web material is conveyed over the contact surface.
3. Method according to claim 1 or 2, wherein the web material is conveyed over the contact surface such that only one side of the web material is in contact with the contact surface.
4. Method according to any one of the preceding claims, wherein the contact body has a conical shape.
5. Method according to any one of the preceding claims, wherein the additive is dispensed through multiple additive dispensing openings provided at different angular positions around the axial direction.
6. Method according to any one of the preceding claims, further comprising conveying a susceptor through the contact body.
7. Method according to claim 6, wherein the susceptor is conveyed through a susceptor guide, wherein the susceptor guide extends beyond the contact body along the axial direction.
8. Device for producing an aerosol-generating rod, comprising:
an additive application assembly comprising a contact body defining a contact surface, wherein at least one additive dispensing opening is provided in the contact surface;
a conveyor system configured to convey a web material over the contact surface such that the web material is in contact with the contact surface; and
a converging device provided downstream of the additive application assembly;

wherein the additive application assembly comprises a susceptor guide configured to guide a susceptor;

wherein the susceptor guide extends beyond the contact body towards the converging device; and

wherein the conveyor system is configured to convey the web material through the converging device to form the web material within the converging device around the susceptor into the rod.

9. Device according to claim 8, wherein the contact surface is curved around an axial direction.

10. Device according to claim 9, wherein the at least one additive dispensing opening comprises multiple additive dispensing openings provided at different angular positions around the axial direction.

11. Device according to claim 9 or 10, wherein the contact surface is tapered along the axial direction.

12. Device according to any one of claims 9 to 11, wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction.

13. Device according to any one of claims 8 to 12, wherein the susceptor guide extends at least partially through the contact body.

14. Device according to any one of claims 8 to 13, wherein the susceptor guide comprises a susceptor exit opening, wherein the susceptor exit opening is at least one of provided upstream of the converging device and provided downstream of the contact body.

15. Use of a contact surface that has at least one additive dispensing opening provided therein in a process for manufacturing an aerosol-generating rod to apply an additive onto a web material and to pre-shape the web material before the web material enters a converging device where the web material is shaped into the rod, wherein the contact surface is curved around an axial direction and tapered along the axial direction, and wherein a continuous portion of the contact surface spans at least an angle of 90 degrees around the axial direction.

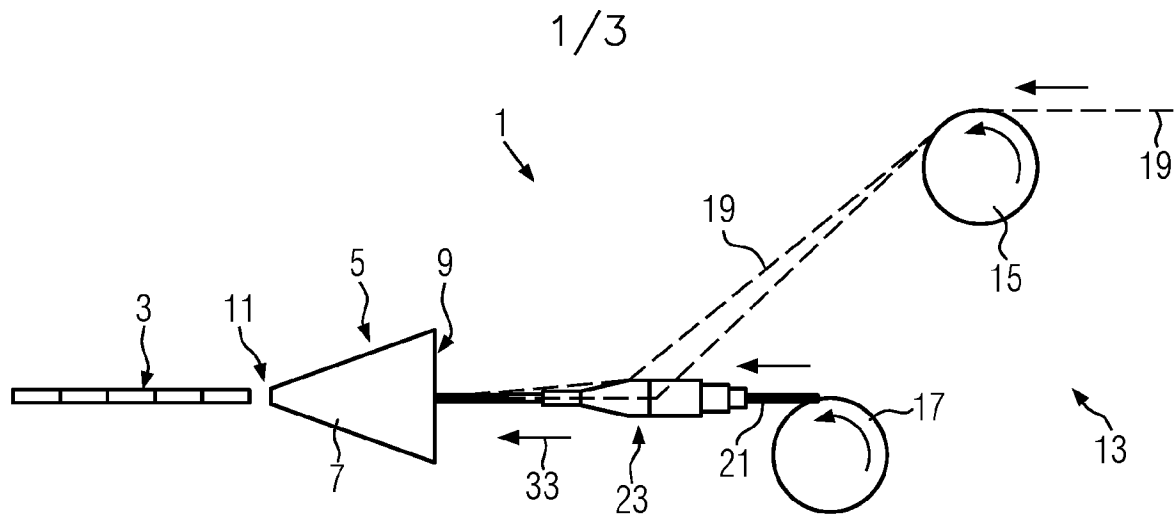


FIG. 1

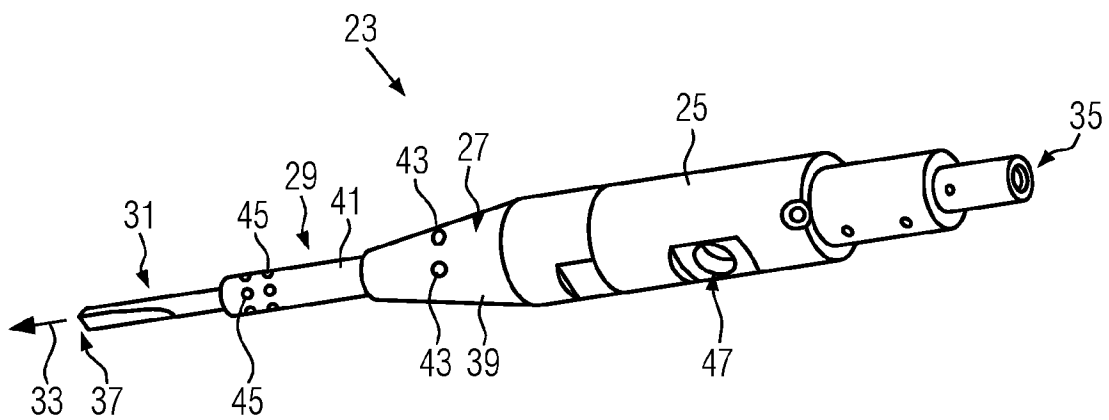


FIG. 2

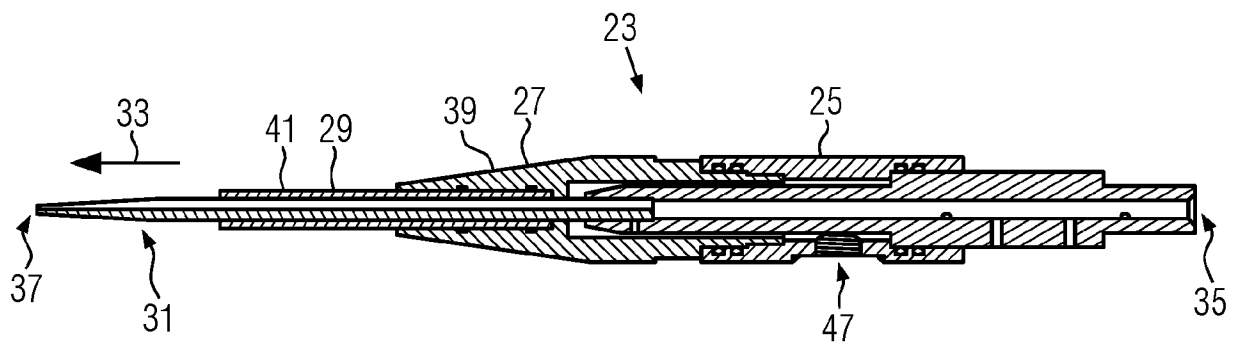


FIG. 3

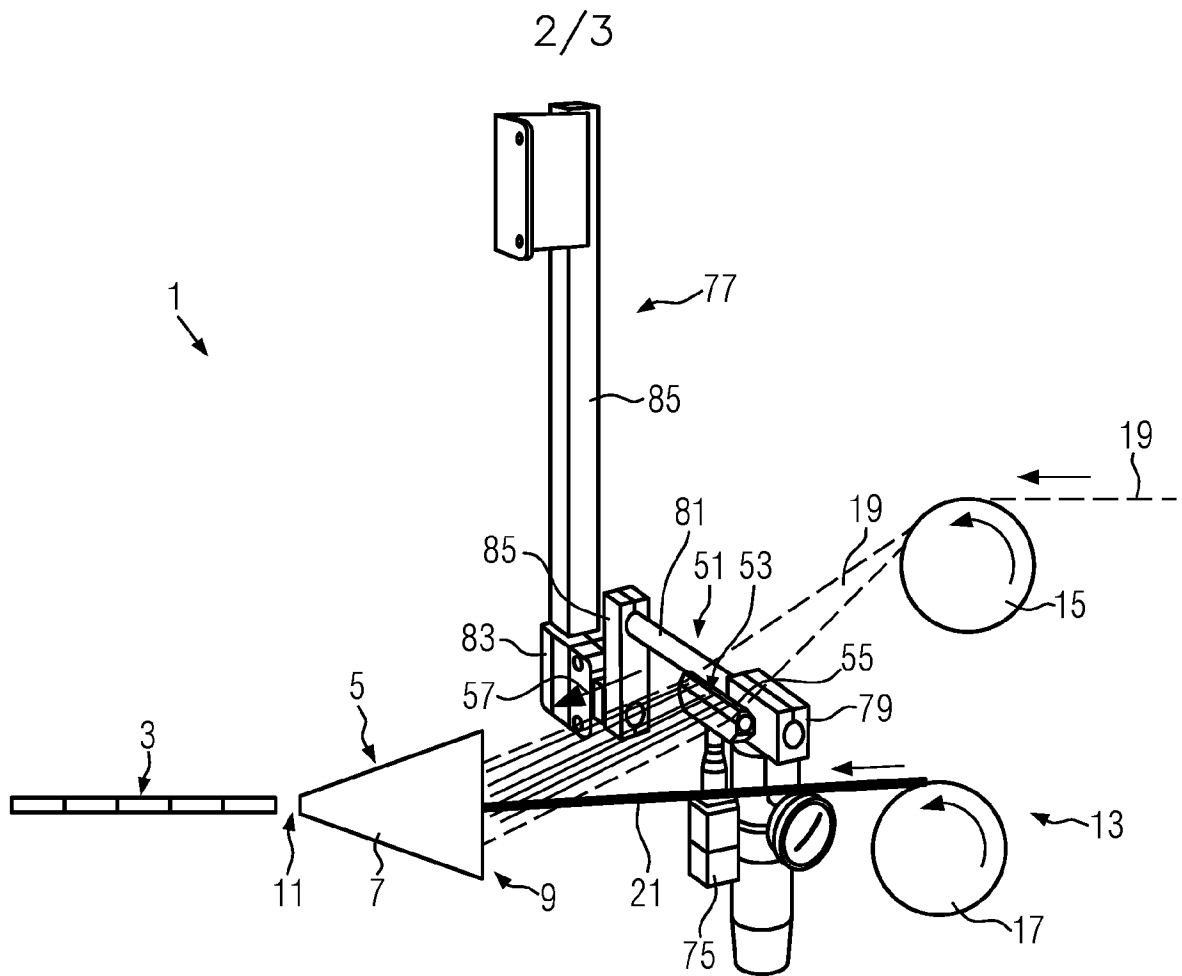


FIG. 4

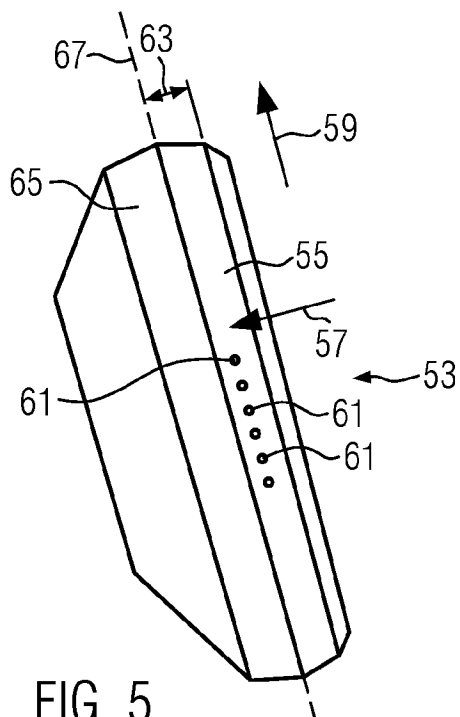


FIG. 5

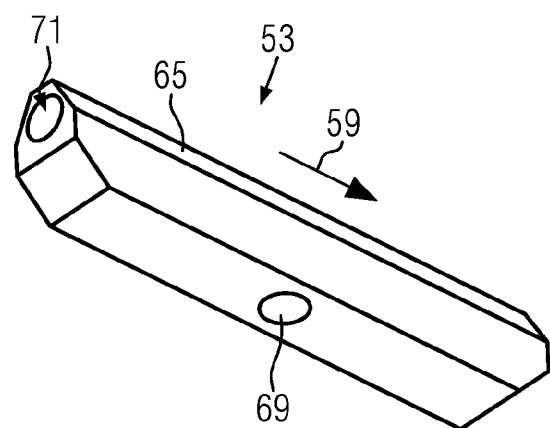


FIG. 6

3/3

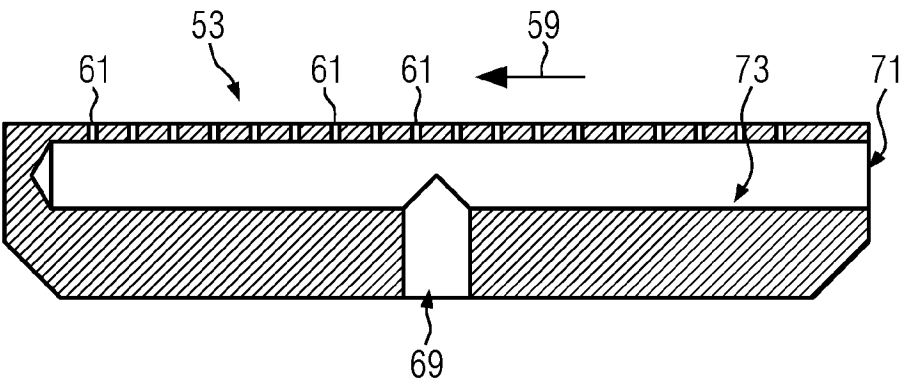


FIG. 7

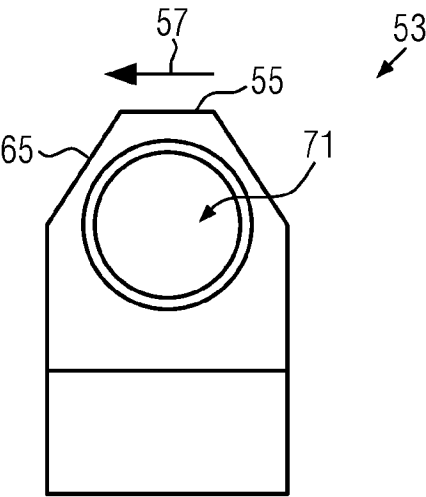


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/058287

A. CLASSIFICATION OF SUBJECT MATTER INV. A24D3/04 A24D1/20 A24D3/02 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A24B A24D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/029118 A1 (NELSON JOHN LARKIN [US] ET AL) 7 February 2008 (2008-02-07)	8, 14
Y	paragraphs [0035], [0036] - [0042]; figures 3-5	9, 10, 12, 13, 15
A	-----	1-7, 11
Y	US 5 387 285 A (RIVERS ERNEST E [US]) 7 February 1995 (1995-02-07)	9, 10, 12, 13, 15
	column 4, line 48 - column 6, line 34; figures 1-5	

A	US 2020/107573 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 9 April 2020 (2020-04-09)	6, 7
	paragraphs [0001] - [0005], [0073] - [0076]; figure 1	

	-/--	
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
26 June 2023		10/07/2023
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Kock, Søren

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2023/058287

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2016/097100 A1 (PHILIP MORRIS PRODUCTS SA [CH]) 23 June 2016 (2016-06-23) abstract; figure 1 -----	1-15
A	WO 2012/025723 A1 (FILTRONA INT LTD [GB]; LISAN AHMAD FASHIHUL [ID] ET AL.) 1 March 2012 (2012-03-01) abstract; figures -----	1-15
A	EP 3 473 112 A1 (GD SPA [IT]) 24 April 2019 (2019-04-24) abstract; figures -----	1, 8, 15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2023/058287

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008029118 A1	07-02-2008	AT 534306 T EP 2046154 A1 ES 2377995 T3 JP 5036817 B2 JP 2010504736 A US 2008029118 A1 US 2010192962 A1 US 2014100099 A1 US 2018317542 A1 WO 2008016839 A1	15-12-2011 15-04-2009 04-04-2012 26-09-2012 18-02-2010 07-02-2008 05-08-2010 10-04-2014 08-11-2018 07-02-2008
US 5387285 A	07-02-1995	EP 0573279 A1 JP H06277035 A US 5387285 A	08-12-1993 04-10-1994 07-02-1995
US 2020107573 A1	09-04-2020	BR 112019020512 A2 CN 110519998 A EP 3638057 A1 ES 2875539 T3 HU E054302 T2 JP 2020522997 A KR 20200018410 A PL 3638057 T3 RU 2019132050 A US 2020107573 A1 WO 2018229086 A1	05-05-2020 29-11-2019 22-04-2020 10-11-2021 30-08-2021 06-08-2020 19-02-2020 02-11-2021 12-04-2021 09-04-2020 20-12-2018
WO 2016097100 A1	23-06-2016	BR 112017010427 A2 CN 106998794 A EP 3232829 A1 HU E043728 T2 JP 6711831 B2 JP 2018500018 A KR 20170094149 A PL 3232829 T3 RU 2017125369 A WO 2016097100 A1	26-12-2017 01-08-2017 25-10-2017 30-09-2019 17-06-2020 11-01-2018 17-08-2017 31-10-2019 18-01-2019 23-06-2016
WO 2012025723 A1	01-03-2012	TW 201215337 A WO 2012025723 A1	16-04-2012 01-03-2012
EP 3473112 A1	24-04-2019	EP 3473112 A1 PL 3473112 T3	24-04-2019 06-09-2021