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(54) **DISPENSING CHAMBER**

(57) A method of manufacturing a rod bearing a metered-amount of an additive material, the method comprising the steps of: providing a continuous material and moving the continuous material along a path; applying a metered-amount of the additive material to the continuous material such that at least a portion of the metered-amount of additive material is fixed to the continuous material; and, collecting excess additive material that has not been fixed to the continuous material. A system for manufacturing a rod bearing a metered-amount of additive material comprising: a chamber (102) comprising an entrance aperture (110) and an exit aperture (112), and a lower portion (108) configured suitable for collecting additive material; a dispenser (131, 132) to apply a metered-amount of additive material to a continuous material when a continuous material is passing through the chamber via the entrance aperture and exit aperture such that at least a portion of the metered-amount of additive material is fixed to the continuous material; and a sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material when the continuous material is within the chamber.

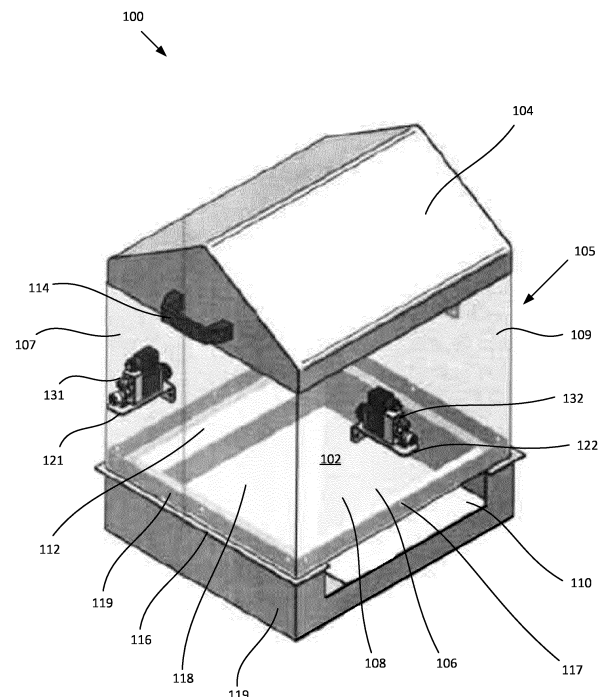


FIG. 1

Description

[0001] The present disclosure relates to a method of manufacturing a rod. More specifically, the present disclosure relates to a method of manufacturing a rod bearing a metered-amount of an additive material. The present disclosure also relates to a system for manufacturing a rod bearing a metered-amount of an additive material. The present disclosure also relates to a method of dispensing additive material, and to an apparatus or system for dispensing additive material.

[0002] The application of an additive material is used in the production of aerosol-generating rods and aerosol-generating articles. Primarily, the application of an additive within the manufacturing process alters the chemical and mechanical properties of the aerosol-generating rod or aerosol-generating article (or both rod and article). In particular, the application of an additive material, such as a plasticiser, concerns the treatment of continuous material (such as tow material or web material) that is used to create filter components, such as the mouth piece filter or hollow acetate tube used in aerosol-generating rods, to be used aerosol-generating articles.

[0003] It would therefore be desirable to mitigate at least one of the aforementioned problems. Particularly, it would be desirable to provide a method (or system) for manufacturing an aerosol-generating article which allows the application of a desired amount of additive material so as to adjust the properties and characteristics of the aerosol-generating article.

[0004] The present invention aims to address or mitigate at least one of these issues. The present invention is defined in the appended claims.

[0005] According to the present invention there is provided a method of manufacturing a rod bearing a metered-amount of an additive material. The method comprises the step of providing a continuous material. The method also comprises the step of moving the continuous sheet material along a path. The method also comprises applying a metered-amount of the additive material to the continuous material such that at least a portion of the metered-amount of additive material is fixed to the continuous material. The method further comprises the step of collecting excess additive material that has not been fixed to the continuous material. The continuous material may be a continuous tow material, for example. The continuous material may additionally or alternatively be a continuous sheet material, for example.

[0006] Thus, a predetermined amount of additive material may be applied, and a portion fixed to the continuous material. The amount of additive material can be predetermined by the user in order to provide the desired properties and performance of the rod, or aerosol-generating article. This method also provides the possibility to test different ways of applying the additive material, both in production or in testing. By providing adjustment in the amount of additive material, testing can be carried out to optimise the amount of additive material. Optimis-

ing the amount of additive material produces aerosol-generating articles having the desired characteristics and properties. The optimised amount of additive material can be applied so as to reduce costs and reduce waste material. Collecting the excess additive material that has not been fixed to the continuous material further adds the benefit of reducing costs and reducing waste material.

[0007] Many of the properties of the aerosol-generating article are determined by the additive, or additives applied. The type of additive, the amount of additive, or combination of additive can be changed depending on the desired characteristics of the aerosol-generating article produced. For example, it may be desirable for the filter of an aerosol-generating article to have a certain firmness such that the filter deforms in a predetermined manner during handling or use. The additive material may alternatively, or additionally, maintain the shape of the aerosol-generating rod (or aerosol-generating article). Since the characteristics and properties of the aerosol-generating article is largely determined by the process of manufacture, the stage of the manufacturing process involving the application of an additive material in particular can be modified in order to impact various key parameters of the filter components. For example, some important parameters include filtering efficiency, resistance to draw, the shape of the filter, and the aerosol-generating article's resistance to compression of components when pressed by the user.

[0008] To produce an aerosol-generating article with the desired parameters, the type, amount of additive material applied, and its location of application on the continuous material can be carefully chosen. Additionally, the process stage of additive application is designed such that the desired performance and characteristics of the aerosol-generating article are produced. For example, in some applications it is preferred to produce aerosol-generating articles having a consistent performance characteristics. In other applications, it is desirable to modify the performance characteristics of aerosol-generating articles, for example, between one batch and the next. By providing a method of manufacturing a rod bearing a metered-amount of an additive material, the amount of waste material is reduced. That is, usually, the amount of excess additive material created which is not used, is reduced.

[0009] This provision would also allow different configurations of the application of additive material to be tested, including having an indication of how much (by any measurement) additive is fixed, or not fixed, to a continuous material in production of an aerosol-generating article. Additionally, the amount of additive material that is wasted is reduced. Advantageously the present invention provides improved measuring of how much additive is fixed to a continuous material. Also, advantageously the present invention may provide a system for applying additive that has less waste of additive.

[0010] In some embodiments, the continuous material

comprises cellulose acetate. Other embodiments of continuous material include, but are not limited to, polylactide, polylactic acid or other fibrous materials, or sheet material, or tow material.

[0011] In some embodiments, the additive material comprises a plasticiser. In other embodiments, the additive material comprises particulate, or a humectant, or a flavourant, or any combination thereof. In some examples, the additive material comprises carbon.

[0012] In some preferred embodiments, the method further comprises the step of: measuring the amount of collected excess additive material that has not been fixed to the continuous material. By measuring the amount of collected excess additive material in this way, an indication of the utilisation of the additive material is provided. That is, it can be determined how much additive material is applied to the continuous material and how much excess additive material is produced which is not applied to the continuous material.

[0013] In specific embodiments, the step of measuring the collected excess additive material that has not been fixed to the continuous material, further comprises the step of: weighing the amount of collected excess additive material that has not been fixed to the continuous material. Weighing the collected excess additive provides an accurate measurement of additive material that has not been applied to the continuous material.

[0014] In some embodiments, the step of measuring the amount of collected excess additive material that has not been fixed to the continuous material, further comprises the step of: measuring the flow rate of the amount of metered-amount of additive material that has not been fixed to the continuous material. By measuring the flow rate of the amount of metered-amount of additive material in this way, an accurate measurement of additive material not applied to the continuous material can be determined. Moreover, the measurement of flow rate provides an indication of rate of increase in the amount of excess additive material. The measurement of flow rate may, for example, be through using a flowmeter adapted to measure the rate of flow from the dispenser of additive material. The flow rate of excess additive material may be measured at a location where the excess additive material is collected. A difference of flow rate may be used to indicate the amount of excess additive material.

[0015] In some preferred embodiments, the method of manufacturing a rod bearing a metered-amount of additive material further comprises the step of: reapplying the collected excess additive material that has not been fixed to the continuous material, to the continuous material. Reapplying the collected excess additive material that has not been fixed to the continuous material is particularly advantageous since additive material which would otherwise be wasted, is reused. This reduces the amount of excess materials and reduces the costs associated with the excess waste material.

[0016] In some preferred embodiments, the method further comprises the step of: providing a chamber to

surround at least a portion of the continuous material when applying a metered-amount of the additive material. By providing a chamber to surround at least a portion of the continuous material when applying a metered-amount of the additive material, there is provided an enclosure wherein the metered-amount of additive material can be applied. Thus, a controlled environment can be provided wherein the application of additive material can take place. Moreover, application of the additive material is maintained in an area so as to prevent additive material from escaping the chamber. Additionally, the localisation of additive material within a defined space is particularly useful as it prevents unintended transport to other areas or parts of the manufacturing site, for example. It also prevents unintended transport of other materials inside the enclosure.

[0017] In some embodiments, the method further comprises the step of: amending the rate of applying the metered-amount of the additive material to the continuous material. This provides an advantage whereby the rate of application can be adjusted to reflect the desired characteristics of the continuous material and thus the rod. Another benefit is the provision of an adjustable rate of application such that different rates of application can be tested.

[0018] In specific embodiments, the step of amending the rate of applying the metered-amount of the additive material to the continuous material further comprises the step of: amending the rate of applying the metered-amount of additive material to the continuous material in response to the measuring of the collected excess additive material that has not been fixed to the continuous material. By amending the rate of application in response to the measuring of collected excess, the rate of application can be selected to substantially reflect the amount of excess additive material that is collected. By way of example, the rate of application can be adjusted accordingly to provide a constant quantity of additive material dispensed. By way of another example, the rate of application can be adjusted to provide a constant quantity of additive material applied. In some embodiments, the rate of application is adjusted such that the amount of additive material applied, less the excess additive material measured, is constant.

[0019] Also, according to the present invention there is provided a system for manufacturing a rod bearing a metered-amount of additive material. The system comprises: a chamber comprising an entrance aperture and an exit aperture, and a lower portion configured suitable for collecting additive material. A dispenser to apply a metered-amount of additive material to a continuous material when a continuous material is passing through the chamber via the entrance aperture and exit aperture such that at least a portion of the metered-amount of additive material is fixed to the continuous material. A sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material when the continuous material is within the chamber.

[0020] Thus, the dispenser applies a predetermined amount of additive material to be affixed to the continuous material. The amount of additive material dispensed can be predetermined in order to provide the desired properties and performance of the rod, and aerosol-generating article. This system also provides the possibility to test different ways of applying the additive material within the chamber, both in production or in testing. By providing flexibility in the amount of additive material, testing can be carried out to optimise the amount of additive material. Optimising the amount of additive material aids producing aerosol-generating articles having the desired characteristics and properties. The optimised amount of additive material can be applied so as to reduce costs and reduce waste material. Using a sensor to measure the amount of the excess additive material that has not been fixed to the continuous material further adds the benefit of providing an indication the extent to which additive material is not fixed to the continuous material.

[0021] In some preferred embodiments, the system further comprises a pump to reapply the collected excess additive material that has not been fixed to the continuous material, to the continuous material. By having a pump which reapplies the collected excess additive material in this way, additive material which would otherwise be wasted, is reused. This reduces the amount of excess materials and reduces the costs associated with the excess waste material.

[0022] In specific embodiments, the sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material comprises a scale to weigh the amount of the collected excess additive material that has not been fixed to the continuous material. Using a scale to weigh the amount of the collected excess additive provides an accurate measurement of additive material that has not been applied to the continuous material.

[0023] In some embodiments, the sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material comprises a flow meter to measure the flow rate of the collected excess additive material that has not been fixed to the continuous material as the collected excess additive material is collected. By having a flow meter that measures the flow rate of the amount of metered-amount of additive material in this way, an accurate measurement of additive material not applied to the continuous material can be determined. Moreover, the measurement of flow rate provides an indication of rate of increase in the amount of excess additive material. In some examples, the flow meter is a logic that tracks the weight on the scale. In some examples, the flow meter determines the rate of change of the measurements over time.

[0024] In some preferred embodiments, the system further comprises a controller to adjust the rate of applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber. This provides an advantage whereby the rate

of application can be adjusted to reflect the desired characteristics of the continuous material and thus the rod. Moreover, the adjustment of the rate of application provided by the controller allows different rates of application to be tested.

[0025] In some preferred embodiments, the controller further comprises a loop back system.

[0026] In specific embodiments, the loop back system adjusts the rate of applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber, in response to the amount of the excess additive material that has not been fixed to the continuous material. This is particularly advantageous because the rate of application can be in response to an amount of additive material not fixed on the continuous material. Thus, the rate of application can be selected to reflect the amount of excess additive material that is collected. For example, the rate of application can be adjusted accordingly to provide a constant quantity of additive material sprayed. In other embodiments, the rate of application can be adjusted such that the amount of additive material sprayed, less the excess additive material measured, is constant. In some embodiments, if there is a large amount of excess additive material (in comparison to the metered-amount of additive material applied) this may reflect that fixation of the additive is low, thus increasing the rate of applying a metered-amount of additive material maybe desired. Alternatively slowing the speed of travel of the continuous material may allow more time for fixation of the metered-amount of additive material to the continuous sheet of additive material.

[0027] In other embodiments, the loop back system adjusts the rate of reapplying the metered-amount of additive material that has not been fixed to the continuous material, in response to the amount of the excess additive material that has not been fixed to the continuous material.

[0028] In yet other embodiments, the loop back system adjusts the rate of both, applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber and reapplying the metered-amount of additive material that has not been fixed to the continuous material, in response to the amount of the excess additive material that has not been fixed to the continuous material. In some embodiments the rate of applying the metered-amount of articulate material comprises adjusting the rate of travel of the continuous sheet of additive material.

[0029] In certain embodiments, the dispenser comprises: a brush; or a nozzle; or both a brush and a nozzle.

[0030] In certain embodiments, the metered-amount of additive material comprises: a plasticiser; or humectant; or flavour; or any combination of plasticiser, humectant or flavour. In some examples, the additive material comprises carbon.

[0031] In specific embodiments, the plasticiser comprises glycerol triacetate. In some embodiments, the

plasticiser comprises trimethylene glycol diacetate.

[0032] In specific embodiments, the chamber is defined by wall portions. In certain embodiments, at least one of the wall portions is transparent. Thus, a user can observe the inside of the chamber through the at least one transparent wall portion.

[0033] As used herein, the term "apply", or "applying" or "application" is used to describe a process of supplying or dispensing a material to the environment or another material.

[0034] As used herein, the term "brush" is used to describe a device that is suitable for applying an additive material such as a powder, or a liquid, to a surface of a material. The brush may be rotatable and may be driven in some embodiments. The brush may comprise, for example, hair or plastic.

[0035] As used herein, the term "chamber" is used to describe an enclosure or an area that provides a barrier to contain contents within the enclosure or area. In some embodiments, the chamber may be physically surrounded by a wall or another form of barrier. The term "chamber" is also used to describe an enclosure or an area which provides a barrier to contain contents within the enclosure or area, but which provides an entry and an exit for providing or removing another material into and out of the chamber respectively.

[0036] As used herein, the term "collect", or "collecting" is used to describe a process of gathering a material together. For example, the collecting of excess additive material that has not been fixed to the continuous material.

[0037] As used herein, the term "crimped" denotes a material having a plurality of substantially parallel ridges or corrugations. It also includes the process of making a material crimped. The ridges may be longitudinal, transverse, angular, straight, waved, continuous, interrupted or any combination thereof.

[0038] As used herein, the term "dispenser" is used to describe a device or a means which is able to dispense, or apply, or otherwise expel an additive material therefrom in order to apply the additive material to another surface or object or into the environment surrounding the dispenser.

[0039] As used herein, the term "excess" is used to describe an amount of a substance or element, for example the additive material, which has not been fixed, for example, to the continuous sheet of additive material.

[0040] As used herein, the term "filter" is used to describe a material that can collect gaseous or particulate matter.

[0041] As used herein, the term "fixed" is used to describe an attachment or fixation of one element to another. The term "fixed" is also used to describe a fastening of an element to another that is securely positioned in place. The fixing in some embodiments, is enabled by electrostatic forces. In some embodiments, the fixing is enabled by adhesion forces, or ionic interactions, or covalent interactions, or van der Waals forces, or any combination of these.

The continuous material may typically be absorbent and may fix additive material by absorption. The continuous material may typically be porous, and the pore may help fix the additive material.

[0042] As used herein, the term "mist" is used to describe an aerosol in the atmosphere. In particular as used herein, the term "mist" is used to describe the metered-amount of additive material that is dispensed and is in the atmosphere within the chamber.

[0043] As used herein, the term "metered-amount" is used to describe a specified quantity of a parameter. The quantity is typically a number, size, value, or extent of a physical parameter. For example, a metered-amount of additive material is a quantifiable total of additive material measured by, for example, its weight, number of particles, an area covered, or a flow rate of the applied additive material. The measurement need not be exact and includes indications and estimations.

[0044] As used herein, the term "measure" is used to describe the procedure of determining a physical parameter via using a sensor or an equivalent. For example, a measurement may be done to quantify the size, amount or degree of the parameter to be determined. The term "measurement" as used herein need not be exact but also includes indications and estimations.

[0045] As used herein, the term "nozzle" is used to describe a specific type of device that is designed to dispense a material. Typically, the nozzle has a narrow end that allows flow, of the material, to be directed. and designed such that the material dispensed therefrom possesses a desired characteristic, such as flow rate or particle size or velocity, for example. Typically, the material to be dispensed is an additive material, for example, a fluid or a small sized solid like a powder of solid material. Multiple nozzles may be used in some examples, to dispense an additive to and from more than one location. Multiple nozzles may also be used to dispense different amounts, or types, of additive material. Additionally, the nozzles may be used to direct the additive material under more than one angle, or in different orientations.

[0046] As used herein, the term "additive", or "additive material" is used to describe a substance introduced to modify the characteristics or properties of a material. This includes fluids, liquids, solutions, and powder, or other small sized solids. In some embodiments, the additive material may comprise a plasticiser. In other embodiments, the additive material comprises a particulate, or a humectant, or a flavourant, or any combination thereof.

[0047] As used herein, the term "reapply", or "reapplying" is used to describe a process of reusing. Reapplying is also used to describe a process of supplying or dispensing a material to the environment or another for a second or subsequent time.

[0048] As used herein the term "rod" is used to describe a component, segment or element, for use in an aerosol-generating article. A "continuous rod" is a precursor to a rod, before cutting to a desired length. The aerosol-generating article may comprise a number of different rods,

for example, a filter rod.

[0049] As used herein, the term "sensor" is used to describe a device which is used to measure a physical property of an environment. For example, the sensor may be a device that is used in the manufacturing process for measuring a metered-amount of additive material. That is, the sensor may be, but not limited to, scales for measuring weight, a flow meter that measures the flow rate, or a liquid level indicator for the measurement of volume. It is envisaged that "sensor", in some embodiments, refers to more than one device used to measure a physical property, each of which may be different.

[0050] As used herein, the term "sheet" is used to describe a material that has a thickness that is much smaller than its length or width.

[0051] Any of the features or steps described herein in relation to one embodiment, aspect or example, of the system (including the apparatus) for manufacturing a rod bearing a metered-amount of additive material, the method of manufacturing a rod bearing a metered-amount of an additive material, or a rod thereof of any of the system (including the apparatus) for manufacturing a rod bearing a metered-amount of additive material, the method of manufacturing a rod bearing a metered-amount of an additive material, or a rod thereof, may be equally applicable to any embodiment, aspect or example of any of the system (including the apparatus) for manufacturing a rod bearing a metered-amount of additive material, the method of manufacturing a rod bearing a metered-amount of an additive material, and a rod bearing a metered-amount of an additive material.

[0052] Reference will now be made to the drawings, which depict one or more embodiments described in this disclosure. However, it will be understood that other embodiments not depicted in the drawings fall within the scope of this disclosure. Like numbers used in the figures refer to like components, steps and the like. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number. In addition, the use of different numbers to refer to components in different figures is not intended to indicate that the different numbered components cannot be the same or similar to other numbered components. The figures are presented for purposes of illustration and not limitation. Schematic drawings presented in the figures are not necessarily to scale.

Figure 1 is a perspective view of a dispensing system according to a first embodiment.

Figure 2 is a front view of the dispensing system in **Figure 1**.

Figure 3 shows an additive dispensing system according to an embodiment.

[0053] **Figure 1** illustrates a dispensing system **100**.

The system **100** comprises a chamber **102** defined by wall portions **105**. The chamber **102** is substantially enclosed by a front wall portion **106**, a rear wall portion **107**, a left wall portion **118**, and a right wall portion **109**. Each of the wall portions **105** in this particular embodiment are transparent. The transparent walls **105** allow a user to observe the inside of the chamber **102** of the system. The chamber **102** in this embodiment is cubic in shape. The chamber **102** may be a different shape, such as a cuboid, pyramid, prism, cylindrical, or spherical. A lid **104** is positioned on the top face of the chamber **102** such that the edges of the lid **104** align with the top edges of the wall portions **105**. As such, the lid **104** covers the top face of the chamber **102**. The left side of the lid **104** is provided with a handle **114**. Optionally, the right side of the lid **104** is provided with another handle (not shown). The provision of the handle **114** allows a user to transport the dispensing system **100** by gripping and handle **114** and lifting the system **100**. In some embodiments, the lid **104** is removable from the chamber **102**, to, for example aid cleaning the inside of the chamber.

[0054] The dispensing system **100** is provided with a base **119**. The base **119** has a profile that is substantially the same as the wall portions **105**. The base **119** has front, rear, left, and right portions which correspond to the respective wall portions **105**. That is, base receiving portion **119** is covered by the wall portions **105**. A lip **116** is provided between the wall portions **105** and the base **119** such that wall portions **105** and thus the chamber **102** is located on the lip **116**. The wall portions **105** and the base **119** are attached via fasteners **117**. The front of the base **119** has an entrance aperture **110**. The rear of the base **119** has an exit aperture **112**. In this embodiment, the entrance aperture **110** and the exit aperture **112** take the form of a slit shape. The entrance aperture **110** and the exit aperture **112** provide access to the chamber **102**. The entrance aperture **110** provides access for a material to be treated. The exit aperture **112** provides access for a material that has been treated. The system **100** is further provided with a lower portion **108** extending from the bottom of the base **119**. The function of the lower portion **108** will be explained in more detail with reference to **Figure 2**.

[0055] A first mounting bracket **121** is attached to the outside of the left wall portion **118**. A first dispenser **131** is positioned on an upward facing surface of the first mounting bracket **121**. Although the first mounting bracket **121** is mounted on an outer surface of the left wall portion **118** and is thus outside the chamber **102**, the first dispenser **131** extends through an aperture (not shown) in the left wall portion **118** such that the first dispenser **131** is at least partially inserted into the chamber **102**. In other embodiments, the aperture (not shown) in the left wall portion **118** is instead a deformable seal (not shown) through which the first dispenser **131** can be inserted to provide access to the chamber **102**. In this particular embodiment, the first dispenser **131** is a nozzle. Additionally, in this embodiment, the first dispenser **131** has an inte-

grated sensor which monitors the conditions within the chamber. For example, the sensor may be configured to measure the pressure, humidity, temperature, moisture, or concentration of an additive material. In some embodiments, a chamber controller (not shown) is coupled to the sensor so as to alter the conditions within the chamber **102**. The first dispenser **131** may be coupled to a dispenser controller (not shown) that is used to control the settings of the first dispenser **131**. The first dispenser **131** is configured to apply an additive material into the chamber **102**. More specifically, the first dispenser **131** is directed towards a tow material that is fed into the chamber **102** via the entrance aperture **110**. In alternative embodiments, the first dispenser **131** is directed away from a tow material that is fed into the chamber **102**. For example, the dispensed additive material dispensed by the first dispenser **131** could create a mist of additive materials wherein the tow material can pass and receive the additive material. In some embodiments, the additive material comprises a plasticiser. In other embodiments, the additive material comprises an additive, or a flavourant, or a humectant, or any combination thereof. The amount of metered additive material, or the rate of applying the metered additive material is predetermined or selected by the user.

[0056] Similarly a second mounting bracket **122** is provided on the outside front wall portion **106**. A second dispenser **132** is positioned on an upward facing surface of the second mounting bracket **122**. The second dispenser **132** extends through an aperture (not shown) on the front wall portion **106** such that the second dispenser **132** is at least partially inserted into the chamber **102**. The second dispenser **132** is configured to apply an additive material into the chamber **102**. The second dispenser **132** is directed towards a tow material that is fed into the chamber **102** via the entrance aperture **110** in some embodiments. However, in other embodiments, the second dispenser **132** is directed away from a tow material that is fed into the chamber **102**. For example, the dispensed additive material dispensed by the second dispenser **132** could create a mist of additive materials wherein the tow material can pass and receive the additive material. In this embodiment, the second dispenser **132** is configured to dispense an additive material (not shown) that is different from the first dispenser **131**. More specifically, the second dispenser **132** dispenses a glycerol triacetate plasticiser, whereas the first dispenser **131** dispenses a flavourant. In other embodiments, however, the second dispenser **132** can also dispense the same additive material. Since the second dispenser **132** is located at a different position from that of the first dispenser **131**, the second dispenser **132** is capable of applying an additive material to a tow material (not shown) at a different location or under a different angle. The amount or the flow rate of the two dispensers **131,132** can be different. For example, a pump of the volumetric type (not shown) may be coupled to either of the dispensers **131,132** such that the amount of additive material pro-

vided to the dispenser **131,132** is known. Also, in this embodiment, the first dispenser **131** is heated, while the second dispenser **132** is not heated.

[0057] Though now shown, additional mounting brackets and additional dispensers may be provided on any of the wall portions **105** (or lid **104** or lower portion **108** for example) to dispense an additive material towards or away from a material on which an additive material is applied. The mounting brackets may instead be arranged on the inside of the chamber **102**, on the inner surfaces of the wall portions **105**. Mounting brackets are not essential to hold the dispensers and some embodiments may not have brackets.

[0058] In use, a tow material (not shown) is unwound from a bobbin. The tow then undergoes a bloomed operation (when a fluffed or bloomed tow material desired). In the blooming process, the tow material is passed between rollers rotating at different speeds to exert tension on the tow material. The tow material is then released, which also releases the tension that was built up. This process creates a tow material with an increased volume and an increased disorder in fibre structure. Additionally, or alternatively, in some embodiments the tow is moved in either or both of the longitudinal and lateral directions in order to separate out individual filaments. This process also provides increased volume and increase disorder in structure.

[0059] Referring to **Figure 1**, the tow material is then pulled into the entrance aperture **110** and is drawn through to the exit aperture **112** via rollers and guides (not shown). In some embodiments, a continuous sheet is unwound from a bobbin at the entrance aperture **110** end, guided through the entrance **110** and exit **112** apertures via guides and rollers. The continuous sheet is then gathered and formed into a continuous rod. In some examples, however, the continuous sheet is instead wound onto a separate bobbin (not shown) at the exit aperture **112** end. A conveyor system may additionally be provided to transport the continuous material through the system **100**. Alternatively, the treated continuous material, in some embodiments, may be transported to be extruded, or placed on a continuous line of wrapping paper to be compressed and made into a continuous length of rod, and additionally move towards the cutting process, where the desired length of rods are cut. In some examples, the continuous material is crimped. For example, a continuous sheet material may be crimped. In some examples, the continuous material is not crimped. For example, a tow material may not undergo crimping. Crimping may occur either before or after treatment within the system **100**. Though not shown in **Figure 1**, in this embodiment a sensor is provided which determines the speed at which the continuous material is fed through the system **100**.

[0060] Treatment of the continuous material occurs within the system **100**, between the entrance aperture **110** and the exit aperture **112**. In some embodiments, the entrance aperture **110** and the exit aperture **112** sup-

port the continuous. After the continuous material is fed into the entrance aperture **110**, the continuous material enters the chamber **102**. In this particular embodiment, the first dispenser **131** and the second dispenser **132** are each directed towards the continuous material. When the dispensers **131,132** dispense an additive material towards the continuous material, the additive material is applied to the continuous material. Specifically, in this embodiment, the first dispenser **131** is directed towards a first portion of the continuous material, while the second dispenser **132** is directed to a different portion of the continuous material. Thus, different additive materials may be applied to different parts of the continuous material. In alternative embodiments, the dispensers **131,132** are directed away from continuous material. Nonetheless, a dispenser directed away from the continuous material dispenses an additive material within the chamber **102**, creating a surrounding mist of additive materials into which the continuous material passes through. The passing of the continuous material through the surrounding mist of additive material applies additive material to the continuous material. A different type of additive material, or a different amount of additive material, can be dispensed by different dispensers **131,132** so as to apply a desired mixture to the continuous material. Also, a different concentration of additive material may be applied by the first dispenser **131** and the second dispenser **132**. However, not all of the additive material dispensed by either the first dispenser **131** or the second dispenser **132** are fixed to the continuous material. Additive material that is not fixed to the continuous material falls towards the bottom of the base **119**, into the lower portion **108**. The lower portion **108** is a collection reservoir that collects the additive material not affixed to the continuous material.

[0061] Figure 2 illustrates a dispensing system **200** having a lid **204**, chamber **202**, base **219**, an entrance aperture **210**, an exit aperture (not shown), handle **214**, dispensers **231,232**, mounting brackets **221,222**, and base receiving portion **218** substantially as previously described in Figure 1. In this particular embodiment, the continuous material is a web of sheet material. In other embodiments, however, the continuous material may be a tow material. The system **200** is also provided with a lower portion **208** extending from the bottom of the base **219**. Additive material that is not fixed to the sheet of web material falls towards the bottom of the base **219** under the effects of gravity, into the lower portion **208**. The additive material, such as plasticiser, additives, or flavourant, which does not fix to the sheet of web material ends up in the lower portion **208**. The lower portion **208** acts as a reservoir that captures any excess additive material. The dispensing system **200** in this embodiment is further provided with a brush **240**. The brush **240** in this embodiment is cylindrical in shape having a longitudinal axis. The brush **240** rotates about its longitudinal axis, which is transversal to the direction of material passing from the entrance aperture **210** to the exit aperture (not

shown). In use, as the sheet of web material passes through the dispensing system **200**, the bottom surface of the sheet of web material comes into contact with the brush **240**. As the brush **240** rotates, the brush **240** picks up additive material from the low portion **208** and applies it to the bottom surface of the sheet of web material. The brush **240**, in some embodiments, applies the excess additive material that is captured in the lower portion **208** to the sheet of web material. In other embodiments, the brush **240** is provided with additive material from a source of additive material, such as a different supply. In specific embodiments, the supply of additive material supplied to the brush **240** may be sourced from the excess additive material captured in the lower portion **208**. In alternative embodiments the supply of additive material may be supplied by other means such as a pump that is coupled to a central core (not shown) of the brush **240**. The brush **240** may apply additive material through openings (not shown) along the brush **240**. The brush **240** is motorised and has a rotational speed which is adjustable. The speed of the brush **240** is selected to correspond with the speed of web material passing through the system **200**. In other embodiments, the speed of the brush **240** is adjusted depending on other parameters, such as the rate or concentration (or both rate and concentration) of additive material dispensed by the first and second applicators **231,232**, or the type of additive material, or the humidity within the chamber **202**, for example.

[0062] The brush **240** contacts the bottom surface of the web material as the continuous sheet of web material passes through the system **200** to apply additive material to the bottom surface of the web material. In another embodiment, the dispensing system **200** is also provided with two additional nozzles (not shown) which are capable of dispensing an additive material. In this embodiment, the nozzles each dispense a different type of plasticiser. Thus, the nozzles are positioned on the four wall portions of the chamber **202**. The nozzles **231,232** are at least partially inserted into the chamber **202** so as to dispense a plasticiser into the chamber **202**. This arrangement is particularly advantageous since plasticiser material is dispensed into the chamber **202** from a different direction. In alternative embodiments, one or more nozzles **231,232** may be inserted fully within the chamber **202**.

[0063] Thus, plasticiser (which can be the same or different plasticiser dispensed by the nozzles **231,232**) is directed towards the sheet of web material from different directions. In alternative embodiments, the nozzles **231,232** dispense a plasticiser into the chamber **202**, directed away from the sheet of web material. This setup creates a plasticiser mist (not shown). When the sheet of web material is passed through the system **200**, the plasticiser material within the mist is received by the sheet of web material. A pump (not shown) is connected and coupled to each of the nozzles **231,232**. The pump is controlled so as to adjust the volumetric flow of plasticiser. The volumetric flow or the amount of plasticiser dis-

pensed by the nozzles **231,232** are adjusted, in some embodiments, depending on the speed of material, the concentration of dispenser in the chamber **202**, the humidity, temperature, or pressure measured with the chamber **202**, for example. The volumetric flow of plasticiser from the nozzles **231,232** can be measured as amount of plasticiser per unit time. It should be appreciated that a system for flushing out the chamber **202** can be provided, the system being capable of flushing out the mist of additive material, or otherwise controlling the environment within the chamber **202**.

[0064] It is unlikely that all of the additive material, for example, plasticiser, is fixed to the sheet of web material passing through the system **202**. Therefore, it is useful to monitor and determine the amount of plasticiser which is fixed to the sheet of web material. It is also useful to monitor and determine the amount of plasticiser not fixed, and the amount of excess additive which is collected in the lower portion reservoir **208** of the system **200**. The pumps coupled to the nozzles **231,232** are able to determine the amount of plasticiser dispensed therefrom. This can be done using a weight-based system or a flowrate-based system, for example. In some embodiments, the amount of plasticiser fixed to the material by the combination of nozzles **231,232** is evaluated by removing the moisture of the sample through evaporation (the sheet of web material with plasticiser fixed thereto). The removal of moisture is done via an oven in this embodiment. The moisture from the sample is removed until the weight of the sample remains constant. The percentage of plasticiser present on the dry sample is then determined.

[0065] In a weight-based system of determining an amount of plasticiser fixed to the material, the pump for providing the plasticiser determines the amount of plasticiser to be dispensed by the nozzles **231,232**. Thus, the amount of plasticiser is known. The amount of excess plasticiser collected in the lower portion **208** of the system **200** can be measured. The excess additive material is collected in a tank (not shown) separate from the system **200**. The tank is then placed on top of a scale that collects the plasticiser not absorbed by the material, and thus can enable weighing of the excess plasticiser. The difference between the amount of plasticiser dispensed by the nozzles **231,232** and the amount of plasticiser weighed by the scales is the amount of plasticiser which is fixed to the sheet of web material passing through the system.

[0066] Alternatively, in a flowrate-based system, a flowmeter (not shown) is used instead of the balance that is used to measure the flow of the plasticiser, instead of the weight of the plasticiser. That is, the difference between the dispensing flow of the nozzles **231,232** and the flow into the tank/lower portion **208** of the system **231,232** from excess additive is determined. The duration of plasticiser application is known also, and the duration of excess plasticiser into the tank or the reservoir **208** is known. The amount of the plasticiser that is fixed to the sheet of web material could then be calculated.

[0067] Some embodiments of the weight-based sys-

tem or the flowrate-based system, comprise a loop back system. Depending on the amount of plasticiser which is not applied to the sheet of web material passing through the system **200**, the pump (not shown) reacts accordingly in order to amend the quantity of plasticiser dispensed by the nozzles **231,232**. This loop back system corresponds or at least is based upon the amount of plasticiser not applied to the material. This can, for example, ensure that a constant quantity of plasticiser is sprayed. The nozzles **231,232** are connected to a single pipe coupled to a pump. Each nozzle **231,232** is equipped with a flowrate control and a valve linked via a loop back system providing feedback to the measurement of flowrate on each nozzle. This configuration similarly allows the amendment of quantity or flowrate (or both quantity and flowrate) of plasticiser dispensed by the nozzles **231,232**. Each nozzle **231,232** may instead dispense an additive or another additive material. A further pump (not shown) may be provided that is coupled to the reservoir **208** which collects and supplies the nozzles **231,232** to reuse and reapply the excess additive material that is not fixed to the sheet of web material, back to the sheet of web material.

[0068] Figure 3 illustrates a dispensing system **300** which is substantially as hereinbefore described with reference to Figure 1. The dispensing system **300** is provided with an applicator which is configured to dispense a plasticiser to a bottom surface of a web material passing through the system **300**. More specifically, a mounting bracket **321** is provided, on which a dispenser **331** is attached. The dispenser **331** is directed upwards such that when a web material passes through the entrance aperture (not shown) and thus through the system **300**, the dispenser **331** dispenses a plasticiser to a bottom surface of the web material.

[0069] In another example, a series of dispensers are provided. Particularly, a row of four dispensers (not shown) are provided. The nozzles (not shown) each apply an additive material to the bottom of the web material along different portions of the web material. Each nozzle may be configured to dispense a different type of additive material, a different concentration of additive material, or the same additive material, for example. In yet another example, there is provided two applicators (not shown). When a web material passes through the system, the applicators apply additive material to the web material at different positions laterally along the width of the web material, as the continuous sheet of additive material travels through the dispensing system. The type or amount of additive material may be the same for both applicators in some embodiments. In other embodiments, the type or amount (or both type and amount) of additive material may be different for the applicators.

[0070] All scientific and technical terms used herein have meanings commonly used in the art unless otherwise specified. The definitions provided herein are to facilitate understanding of certain terms used frequently herein.

[0071] As used in this specification and the appended claims, the singular forms "a", "an", and "the" encompass embodiments having plural referents, unless the content clearly dictates otherwise.

[0072] As used in this specification and the appended claims, the term "or" is generally employed in its sense including, alternatively or in addition, unless the content clearly dictates otherwise.

[0073] As used herein, "have", "having", "include", "including", "comprise", "comprising" or the like are used in their open-ended sense, and generally mean "including, but not limited to". It will be understood that "consisting essentially of", "consisting of", and the like are subsumed in "comprising," and the like.

[0074] The words "preferred" and "preferably" refer to embodiments of the invention that may afford certain benefits under certain circumstances. However, other embodiments may also be preferred under the same or other circumstances. Furthermore, the recitation of one or more preferred embodiments does not imply that other embodiments are not useful, and, is not intended to exclude other embodiments from the scope of the disclosure, including the claims.

[0075] Any direction referred to herein, such as "top," "bottom," "left," "right," "upper," "lower," and other directions or orientations are described herein for clarity and brevity are not intended to be limiting of an actual device or system. Devices and systems described herein may be used in a number of directions and orientations.

[0076] The embodiments exemplified above are not limiting. Other embodiments consistent with the embodiments described above will be apparent to those skilled in the art.

Claims

1. A method of manufacturing a rod bearing a metered-amount of an additive material, the method comprising the steps of:
 - providing a continuous material and moving the continuous material along a path;
 - applying a metered-amount of the additive material to the continuous material such that at least a portion of the metered-amount of additive material is fixed to the continuous material; and,
 - collecting excess additive material that has not been fixed to the continuous material.
2. A method of manufacturing a rod according to claim 1, wherein the method further comprises the step of: measuring the amount of collected excess additive material that has not been fixed to the continuous material.
3. A method of manufacturing a rod according to claim 2, wherein the step of measuring the collected ex-

cess additive material that has not been fixed to the continuous material, further comprises the step of: weighing the amount of collected excess additive material that has not been fixed to the continuous material.

4. A method of manufacturing a rod according to claim 2 or 3, wherein the step of measuring the amount of collected excess additive material that has not been fixed to the continuous material, further comprises the step of: measuring the flow rate of the amount of metered-amount of additive material that has not been fixed to the continuous material.
5. A method of manufacturing a rod according to claim 1 or 2, wherein the method further comprises the step of:
 - reapplying the collected excess additive material that has not been fixed to the continuous material, to the continuous material.
6. A method of manufacturing a rod according to any preceding claim, wherein the method further comprises the step of: providing a chamber to surround at least a portion of the continuous material when applying a metered-amount of the additive material.
7. A method of manufacturing a rod according to any preceding claim, wherein the method further comprises the step of: amending the rate of applying the metered-amount of the additive material to the continuous material.
8. A method of manufacturing a rod according to claim 7, wherein the step of amending the rate of applying the metered-amount of the additive material to the continuous material further comprises the step of: amending the rate of applying the metered-amount of additive material to the continuous material in response to measuring the collected excess additive material that has not been fixed to the continuous material.
9. A system for manufacturing a rod bearing a metered-amount of additive material comprising:
 - a chamber comprising an entrance aperture and an exit aperture, and a lower portion configured suitable for collecting additive material;
 - a dispenser to apply a metered-amount of additive material to a continuous material when the continuous material is passing through the chamber via the entrance aperture and exit aperture such that at least a portion of the metered-amount of additive material is fixed to the continuous material; and,
 - a sensor for measuring an amount of the col-

lected excess additive material that has not been fixed to the continuous material when the continuous material is within the chamber.

10. A system for manufacturing a rod according to claim 9, wherein the system further comprises a pump to reapply the collected excess additive material that has not been fixed to the continuous material, to the continuous material. 5
11. A system for manufacturing a rod according to either claim 9 or 10, wherein the sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material comprises a scale to weigh the amount of the collected excess additive material that has not been fixed to the continuous material. 10
12. A system for manufacturing a rod according to any one of claims 9, 10 or 11, wherein the sensor for measuring an amount of the collected excess additive material that has not been fixed to the continuous material comprises a flow meter to measure the flow rate of the collected excess additive material that has not been fixed to the continuous material as the collected excess additive material is collected. 20 25
13. A system for manufacturing a rod according to any one of claims 9 to 12, wherein the system further comprises a controller to adjust the rate of applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber. 30
14. A system for manufacturing a rod according to claim 13 wherein the controller further comprises a loop back system to adjust the rate of: 35
 - a) applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber; or, 40
 - b) reapplying the metered-amount of additive material that has not been fixed to the continuous material; or,
 - c) both, applying the metered-amount of additive material to the continuous material when the continuous sheet is within the chamber and reapplying the metered-amount of additive material that has not been fixed to the continuous material; 45 50

in response to the amount of the excess additive material that has not been fixed to the continuous material. 55

15. A system for manufacturing a rod according to any one of claims 9 to 14, wherein the dispenser comprises: a brush; or a nozzle; or both a brush and a

nozzle.

16. A system for manufacturing a rod according to any one of claims 9 to 15, wherein the metered-amount of additive material comprises: plasticiser; or humectant; or flavour; or any combination of plasticiser, humectant or flavour.
17. A system for manufacturing a rod according to any one of claims 9 to 16, wherein the chamber is defined by wall portions.
18. A system for manufacturing a rod according to claim 17, wherein at least one of the wall portions is transparent.

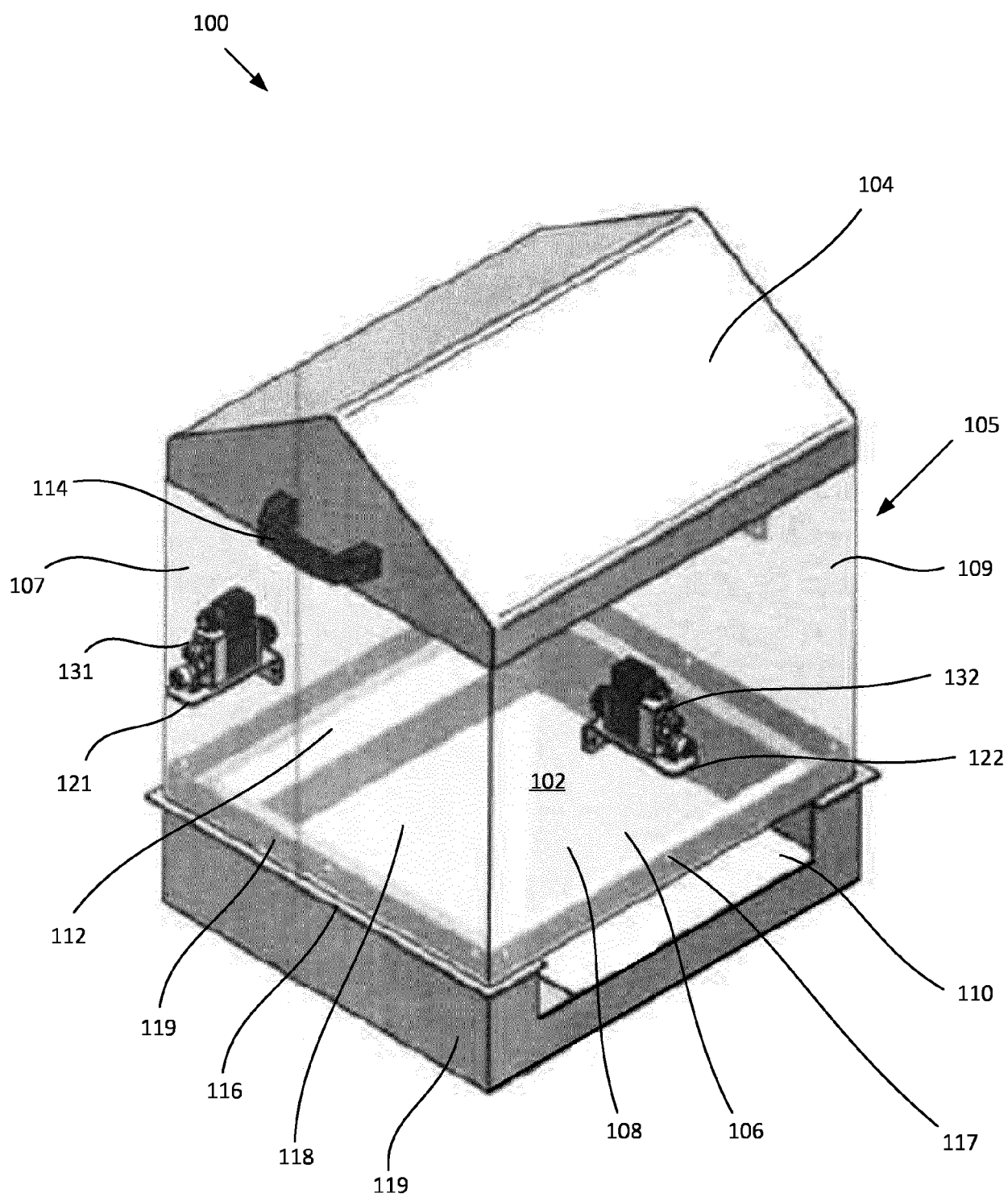


FIG. 1

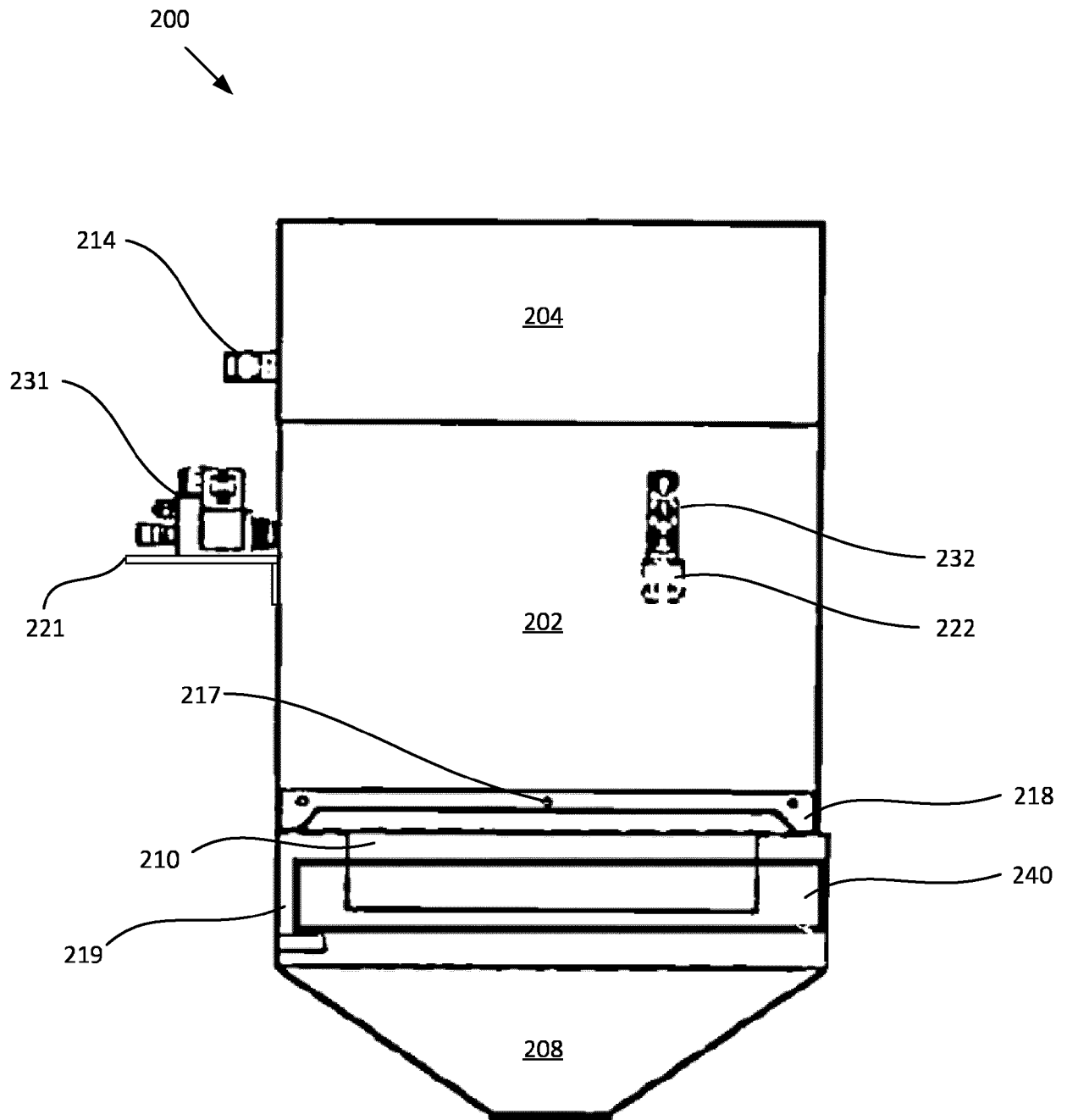


FIG. 2

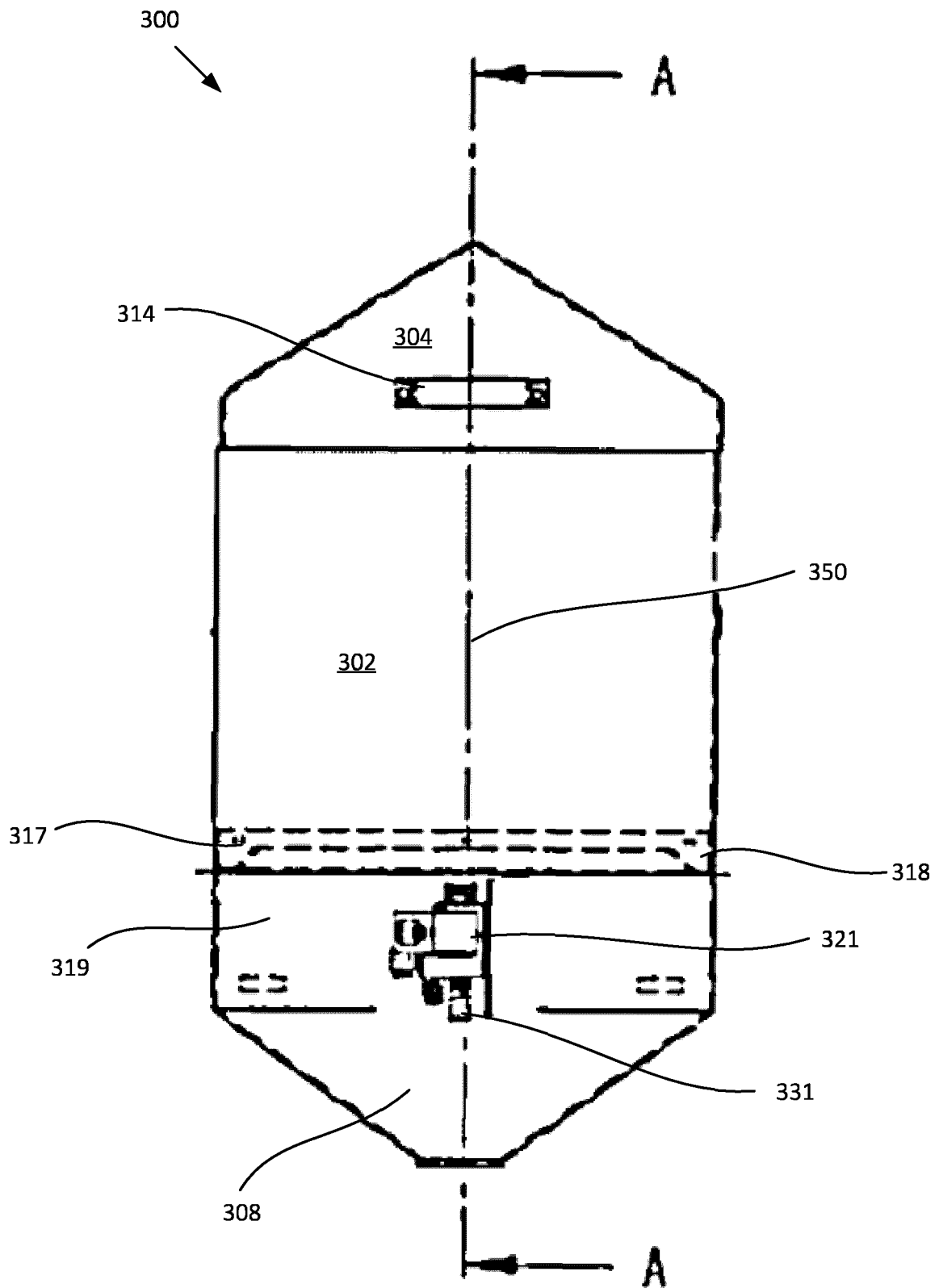


FIG. 3



EUROPEAN SEARCH REPORT

 Application Number
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Place of search Munich		Date of completion of the search 23 March 2020	Examiner Kirchmayr, Katrin
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