Abstract: In the method and apparatus for introducing metered amounts of particles into a continuous flow of material a transfer wheel (5) comprising a plurality of peripherally arranged pockets (8) filled with a metered amount of particles (1) is rotated. Suction is applied from inside the transfer wheel (5) to the pockets (8) of the transfer wheel (5) to hold the metered amount of particles (1) inside the pockets (8) of the transfer wheel (5). The suction is then relieved and the metered amount of particles (1) is transferred from the pockets (8) of the transfer wheel (5) into a gas flow at a transfer location. The gas flow has a direction tangential to the transfer wheel at the transfer location. The metered amounts of particles are transported in the gas flow to the continuous flow of material.
Method and apparatus for introducing a metered amount of particles into a continuous flow of material

The invention relates to a method and apparatus for introducing metered amounts of particles in a reproducible manner during manufacture of particle containing products. More particularly, the invention relates to precise and repetitive introduction of particles into a continuous flow of material, for example during manufacture of smoking articles or components of smoking articles.

It is known to repetitively introduce metered amounts of particles into spaced apart locations in a flow of material, such as a filter tow. For example, US patent US 6,723,033 discloses a wheel transferring metered amounts of particles into the filter tow. Accordingly, recesses are formed in the tow into which the metered amounts are released. International patent application WO-A-2006/067629 discloses the use of a gas pulse applied in an axial direction of a metering wheel to remove particulate material from a pocket on that metering wheel.

There is a continued need to provide methods and apparatuses that provide for a highly accurate introduction of metered amounts of particles into a continuous flow of material at predefined locations.

According to a first aspect of the present invention, there is provided a method for introducing metered amounts of particles into a continuous flow of material. The method comprises the step of rotating a transfer wheel comprising a plurality of peripherally arranged pockets filled with a metered amount of particles. The method further comprises the step of applying suction from inside the transfer wheel to the pockets of the transfer wheel to hold the metered amounts of particles inside the pockets of the transfer wheel. Still further, the method comprises the steps of relieving the suction and transferring the metered amount of particles from the pockets of the transfer wheel into a gas flow at a transfer location. According to the invention, the gas flow has a direction tangential to the transfer wheel at the transfer location. Further, the method comprises the step of transporting the metered amounts of particles in the gas flow to the continuous flow of material.
Metered amounts of particles are held by suction in the pockets in the transfer wheel. The amounts of metered particles are transported by rotation of the transfer wheel to the transfer location where the amounts of metered particles are transferred into a gas flow. The gas flow has a direction, which is tangential to the circumference of the transfer wheel at the transfer location. By this, the particle speed vector of the particles on the wheel and the gas speed vector of the gas flow are substantially parallel in the transfer area. Due to the alignment of the particle speed vector and gas speed vector, this allows for a precise transfer of the amount of particles from the pockets in the transfer wheel into the gas flow and subsequently, the transfer of the particles into the flow of material. The amounts of particles are transferred as a clearly defined load of particles with no or only little spatial spread of the particles of the metered amounts of particles. In addition, it also allows an adaption of the circumferential speed of the transfer wheel to the speed of the gas flow or vice versa. By this, a transfer precision of the metered amounts of particles from the transfer wheel to the gas flow may further be enhanced, since the amount of particles transferred from the transfer wheel to the gas flow do ideally not undergo any significant acceleration in any direction, in particular not in a forward direction. Instead the particles that leave the wheel in the transfer zone may continue their path along the particle speed vector under inertia. Thereby, only little change of forces is acting upon the individual particles of one load of particles during and after transfer. Further, by the provision of a delivery of metered amounts of particles from a transfer wheel into a continuous flow of material via a tangentially flowing gas, it is possible to adapt the speed of the metered amounts of particles to the speed of the flow of material. It is also possible to deliver and insert the amount of particles essentially parallel into the flow of material. All measures, taken individually and in combination, enhance the accuracy of the delivery or an introduction, respectively, of an individual metered amount of particles to a predetermined position in the flow of material.

Preferably, a circumferential speed of the transfer wheel is adapted to a linear speed of the flow of material, for example a tobacco stream or filter tow, in a rod making apparatus. Such a rod making apparatus may be a tobacco rod making apparatus, where for example flavorant containing particles are to be
introduced into a continuous stream of tobacco in metered amounts at precise locations. Providing metered amounts of particles into a flow of material via a gas flow also provides the possibility of introducing the particles into the flow of material with very low disturbance. Any interference with the flow of material that may adversely affect machine parts arranged after the location where particle introduction takes place, may be avoided or minimized. Adverse effects may for example be jamming or choking of, for example, hoppers.

The term "particles" as used in the present invention denotes small objects that have a geometrical shape with well-defined boundaries, in contrast to liquids or gases. By way of example, particles include small objects which are entirely made of solid state substances, particles having a shell or envelope made of a solid substance enclosing a liquid or gaseous core, particles like gelatin capsules having well-defined boundaries and matrix materials that do not have a shell and core structure but that have releasable substances within their matrix structure that can be released for example upon the application of pressure or heat. Preferably, the sizes of the particles range between about 0.2 mm and about 3.5 mm; more preferably, the sizes of the particles range between about 0.5 mm and about 2.0 mm, for example 1.5 to 1.8 mm. Preferably, the particles comprise a flavorant, for example, menthol. Preferably, the particles are sensitive to heat, that is, a particle can release its content or a content of the particle is activated when a sufficient temperature acts on the particle. Preferably, the particles are adapted to being introduced into smoking articles, such as cigarettes.

According to one aspect of the method according to the invention, the method further comprises the step of introducing the metered amounts of particles into the continuous flow of material under an acute angle of between 0 degrees and about 45 degrees, more preferably between about 0 degrees and about 20 degrees. By the introduction of the amount of particles under an acute angle the direction of the flow of the material and the flow direction of the amounts of particles correspond or nearly correspond to each other at the introduction location from the gas flow into the material flow. Thereby, forces acting on the particles in other directions than the flow direction of the particles are minimized. A spread of an individual load of particles may therefore be minimized. In a preferred
embodiment, also the speed of the two flows (the flow of the metered amount of particles in the gas flow and the material flow the particles are to be delivered into) may be adapted to each other. They may especially be made to correspond to each other, such that for example the speed of the amounts of particles is accelerated or slowed down to the speed of the material flow. Both measures allow for a very precise insertion of the metered amount of particles at a predefined location in the flow of material.

According to another aspect of the method according to the invention, the step of transferring the metered amount of particles from the pockets of the transfer wheel into the gas flow comprises rotating a toothed wheel. The teeth of the toothed wheel engage the pockets of the transfer wheel and thereby transfer the content of the pockets one at a time into the gas flow at the transfer location.

According to the invention, a tooth of the toothed wheel engages a pocket at the transfer location or prior to reaching the transfer location. The toothed wheel lifts the content of the pocket out of the pocket such that the gas flowing tangentially to the circumference of the transfer wheel may pick up the metered amount of particles from the toothed wheel. Preferably, the content of the pocket is lifted up to the circumference of the transfer wheel. It may even be lifted further up further into for example a delivery tube the gas is flowing in. The toothed wheel rotates in the same direction as the transfer wheel and preferably has a circumferential speed at the transfer location corresponding to the circumferential speed of the transfer wheel. A moving direction of the particles given by the rotation of the transfer wheel is taken over by the toothed wheel. Preferably, the teeth of the toothed wheel have distances corresponding to a distance of pockets in the transfer wheel. Upon rotation of the toothed wheel one pocket load of particles is then transferred via the space between two teeth of the toothed wheel into the gas flow.

Typically, the spacing of the pockets on the metering wheel substantially corresponds to the spacing of the particles within the flow of material, however, an alteration between the distance of the particle packages in the flow of material and in the pockets on the metering wheel may be achieved by a difference in the speed of the gas flow compared to the tangential speed of the pockets on the
wheel in the transfer zone. For example, where the speed of the gas flow is slightly higher than the tangential speed of the pockets on the wheel in the transfer zone, the spacing of the packets of particles in the gas flow will increase accordingly.

According to a further aspect of the method according to the invention, the method comprises the step of metering the amount of particles by rotating the transfer wheel past a filling chamber containing particles.

The pockets in the transfer wheel may directly be used for metering the amounts of particles to be introduced into the flow of material. Therein, the size of the pocket corresponds to the amount of particles that shall be introduced into the flow of material. In order to fill the pockets in the transfer wheel the pockets are passed through or along a filling chamber containing particles. In other embodiments, the amounts of particles in the pockets of the transfer wheel may be pre-metered, for example by a metering wheel. In these embodiments already metered amounts of particles are transferred into the pockets of the transfer wheel. Each pocket may be dimensioned to hold one particle, several particles or several hundreds of particles, depending on the size of the particles. In some embodiments, it may be preferred that the volume of the pockets is deliberately larger than the metered volume of the particles that are intended to be transferred into the flow of material. For example, it may be significantly faster and simpler to fill 80 percent of a larger pocket than filling the same amount of material to 100 percent into a smaller pocket of the metering wheel. A filling of a precise amount of particles into a pocket can be achieved even when the pocket is not deliberately filled completely. One way of controlling the filling of a pocket may be, for example, controlling the suction that is applied to the bottom of such a pocket in order to maintain the particles within the pocket during rotation to the transfer zone, where a higher amount of suction typically will result in a larger filled volume of the pocket.

Therefore and according to another aspect of the method according to the invention, the method comprises the step of rotating a metering wheel comprising a plurality of peripherally arranged pockets past a filling chamber containing particles. Suction is supplied from inside the metering wheel to the pockets of the metering wheel to draw particles from the filling chamber into the pockets of the
metering wheel. The method further comprises the step of relieving the suction to thereby enable the discharging of the particles from the pockets of the metering wheel into the pockets of the transfer wheel.

Using a separate metering wheel for metering the amount of particles to be introduced into a flow of material allows a high flexibility in the apparatus according to the invention. For example, the filling and metering process may be separated from the transfer process. The processes of filling and metering may therefore be optimized basically independently of each other. A filling process preferably makes use of gravitational force. It may for example be optimized by using a downward movement of the metering wheel when passing the filling chamber, for example to lengthen a time a pocket dwells in the filling chamber. By this a desired level of filling of the pocket may be supported to guarantee the preciseness of the amount of particles to be delivered to the flow of material. A delivery and introduction of particles is preferably optimized in view of the direction and speed of the flow of the metered amounts of particles relative to the direction and speed of the flow of material. In addition, a different amount of particles for introducing into the flow of material may be metered by exchanging only the metering wheel having pockets of a defined size by a metering wheel having pockets of a different defined size. Alternatively or in addition, a variation in the amount of suction may be varied to achieve different desired amount of particles. When using a metering wheel, the pockets of the transfer wheel then typically have sizes larger than required for accommodating the amount of particles to be introduced into the flow of material. Larger pockets may facilitate a transfer of the metered amount of particles from the metering wheel to the transfer wheel.

Preferably, pockets in metering wheel and transfer wheel comprise perforated or otherwise partly open bottom walls such that suction may be applied from inside the respective wheels to the perforated bottom walls. Particles may be drawn inside the pockets and held in the pockets by the suction. By relieving the suction applied to the pockets, a discharging or transfer of amounts of particles from one wheel to the other wheel or into the gas flow is enabled. A discharging from metering wheel to transfer wheel may also be supported by a short jet of gas,
for example air, in order to neutralize any residual vacuum that might still be present.

According to another aspect of the method according to the invention, the method further comprises the step of directing a gas flow through the filling chamber to assist in filling the pockets of the metering wheel or transfer wheel, respectively, with particles from the filling chamber.

The filling of pockets may be supported by a gas flow in different ways. A gas flow through the filling chamber may influence a particle flow in the filling chamber. For example, particles may be directed into the direction of the pockets passing the filling chamber. The gas flow may also be used to adapt the particle flow in the filling chamber to the speed of the pockets passing through the filling chamber. By this, for example, a permanent refill of the filling chamber may be guaranteed and jamming of particles may be prevented. The above mentioned kinds of assisting gas flows may also be combined to optimize the filling of pockets.

According to another aspect of the method according to the invention, the method further comprises the step of performing the introduction of metered amounts of particles into the continuous flow of material in a contactless manner. If the introduction of particles is provided in a contactless manner, no mechanical interference with the flow of material occurs. Thus, the flow of material basically remains undisturbed and correspondingly also any further process treating the flow of material. Especially, the risk of an adverse effect of machine parts, for example only allowing for the passing of a certain amount of material in a given dimension, may be minimized or eliminated.

According to another aspect of the invention, there is provided an apparatus for introducing metered amounts of particles into a continuous flow of material. The apparatus comprises a rotatable transfer wheel comprising a plurality of peripherally arranged pockets for accommodating metered amounts of particles. The transfer wheel comprises a vacuum manifold including a vacuum chamber for application of suction to the pockets for holding the metered amount of particles in the pockets of the transfer wheel. The apparatus further comprises a transfer element for transferring the metered amounts of particles from the pockets of the
transfer wheel to a delivery tube. The delivery tube is arranged tangentially to the periphery of the transfer wheel for receiving the metered amounts of particles from the pockets of the transfer wheel. Preferably, the delivery tube is substantially straight along the entire length. This is particularly advantageous for the transport of particles of activated charcoal as these would otherwise may deteriorate the inside of the delivery tube in an area of contact with the activated charcoal particles. The apparatus also comprises a gas flow device being in fluid communication with the delivery tube for providing a gas flow inside the delivery tube for transporting the amounts of metered particles to a continuous flow of material. A gas flow device may for example be a vacuum chamber arranged downstream of the delivery tube and acting on the delivery tube. Such a vacuum chamber may for example be a suction chamber of a rod making apparatus. However, a gas flow device may also be a gas application device for applying a gas overpressure to the delivery tube. In preferred embodiments, the gas flow device comprises a gas application device and a flow control for providing a gas flow in the delivery tube and for adapting the gas flow in the delivery tube to a speed of the continuous flow of material.

Advantages of the aspects of the apparatus according to the invention have already been discussed above in connection with the corresponding aspects of the method, so that they are not discussed again.

According to an aspect of the apparatus according to the invention, the transfer element for transferring the metered amounts of particles from the pockets of the transfer wheel to the delivery tube is a rotatable toothed wheel. The toothed wheel is arranged such that the teeth of the toothed wheel may engage the pockets of the transfer wheel upon rotation of the toothed wheel. Thereby the content of one pocket at a time is transferred into the delivery tube.

According to another aspect of the apparatus according to the invention, the apparatus further comprises a rotatable metering wheel comprising a plurality of peripherally arranged pockets for metering and accommodating metered amounts of particles. The metering wheel comprises a vacuum manifold including a vacuum chamber for application of suction to the pockets of the metering wheel as the metering wheel rotates. The apparatus further comprises a filling chamber for
particles from which particles may be withdrawn into the pockets by the applied suction. The apparatus further comprises a discharging element for discharging the metered amounts of particles from the pockets of the metering wheel into the pockets of the transfer wheel. A discharging element may be a vacuum interruption device, for example a shutter, which is preferably combined with a gas nozzle for providing gas to remove residual vacuum.

According to an aspect of the apparatus according to the invention, the filling chamber comprises a filling support element for supporting the filling of particles from the filling chamber into the pockets of the metering wheel. According to some preferred embodiments of the apparatus according to the invention, the filling support element is a bleed valve or a deflector plate for directing a particle flow in the filling chamber into the direction of the pockets in the metering wheel or the transfer wheel, respectively, that pass through the filling chamber.

According to yet another aspect of the apparatus according to the invention, the apparatus further comprises a synchronization unit. Preferably, the synchronization unit is used for synchronizing the circumferential speed of the transfer wheel with a linear speed of the continuous flow of material. It may for example be synchronized with a speed of a machine, for example a rod making apparatus defining the speed of the flow of material. The synchronization unit may also be used for synchronizing further parts of the apparatus according to the invention, such as for example a metering wheel or a toothed wheel with the transfer wheel.

The parallel or almost parallel transfer of particles from one apparatus element to another or from an apparatus element into the material flow allows for a very precise transfer of the particles with little or no spatial spread of the individual particle loads. If the speed of the individual apparatus elements at transfer locations (including discharging and introduction locations) are adapted to each other such a spatial spread may also be minimized. In a combination, a very precise and well defined introduction of exactly metered amounts of particles is possible at well-defined preset locations in a flow of material.

The method and apparatus according to the invention are preferably used in the manufacture of smoking articles or parts of smoking articles such as tobacco
rods and filter elements. However, the method and apparatus according to the invention may also be used in other processes, where particles have to be metered and individual amounts of particles shall repetitively be introduced into a flow of material at precise locations.

The invention is further described with regard to an embodiment, which is illustrated by means of the following drawings, wherein

Fig. 1 shows a front view of an embodiment of the apparatus according to the invention for use in the production of a smoking article;

Fig. 2 shows a rear view of the embodiment according to Fig. 1.

In Fig. 1 and Fig. 2 loose particles 1, for example particles comprising a flavorant or activated charcoal, are fed into a top end of a vertically arranged filling tube 2. The particles 1 are guided preferably via gravitational force in filling tube 2 into a filling chamber 3. From filling chamber 3 particles 1 are filled into pockets 8 arranged in the circumference of a vertically rotatable metering wheel 5. The sizes of the pockets 8 in metering wheel 5 thereby define the amount of particles per pocket and accordingly also the so metered amount of particles to be later on introduced into a flow of material 22. The particles in the pockets 8 are transported by rotation of the metering wheel 5 to a discharging location 100. In this embodiment discharging location 100 is located opposite the location where pockets 8 of metering wheel 5 are filled. At discharging location 100, the amounts of particles are discharged from metering wheel 5 to a vertically rotatable transfer wheel 11. Via rotation of transfer wheel 11, the individual amounts of particles are transported in pockets 21 of transfer wheel 11 to a transfer location 200. With support from a toothed wheel 14 acting as transfer element (shown in Fig. 2) the individual amounts of particles are one by one transferred into delivery tube 17. Delivery tube 17 is arranged tangentially to transfer wheel 11 at transfer location 200. A gas flow in delivery tube 17 takes up the individual loads of particles and transports them in the form of particle pulses 18 to the continuous flow of material 22 for introduction of the amounts of particles into the flow of material 22. A rotation direction of the wheels is indicated by arrows.

The flow of material 22 is preferably arranged parallel or under a small acute angle to the gas flow containing the particle pulses 18 at an introduction
location. Thereby, no or only little directional change of the speed vector of the particles upon delivery into delivery tube 17 and upon introduction into material flow 22 takes place.

An introduction of the particle pulses 18 into material flow 22 may be performed in a contactless manner by arranging an end of delivery tube 17 at a distance to the material flow 22. An introduction depth of the particles in the material flow may for example be adjusted by the pressure of the gas flow. However, particle pulses 18 may also be introduced into the flow of material by the delivery tube 17 reaching into the material flow.

In order to guarantee an exact amount of particles to be introduced into a flow of material 22 a filling of pockets 8 of a metering wheel 5 should be exact and reproducible. In order to support a filling, filling tube 2 may be provided with a gas flow supporting a flow of particles in the filling wheel. Filling chamber 3 is provided with a slide 4 that directs the particle flow towards a pocket 8 of metering wheel 5 that passes through filling chamber 3. A preferably adjustable bleed valve 23 connected to a pressurized air source (not shown), vents air into filling chamber 3 to fine tune the filling of particles into the pockets. Such an air flow may also prevent a jamming of particles in the filling chamber.

A vacuum chamber 10 is provided inside metering wheel 5. Through vacuum means (not shown) suction may be applied to vacuum chamber 10 and pockets 8, for example though a perforated bottom wall 9 of the pockets. This suction pulls particles from filling chamber 3 into pockets 8 and holds the particles in the pockets. Scraper 7 arranged downstream of filling chamber 3 trims excess particles protruding from the pockets 8 and particles that may be otherwise stuck to the perimeter of the metering wheel 5, for example by electrostatic forces. Excess particles 6 having passed filling chamber 3 and not having been filled into a pocket, may be re-fed into filling tube 2. The re-feeding may be performed through a dosing valve 201 arranged at the top end of filling tube 2, where the excess particles 6 are mixed with fresh particles 1 for a next filling of pockets.

When in the discharging location 100, the suction applied to pockets 8 of metering wheel 5 is turned off or interrupted such that a discharging of the amount of particles from the pockets of the metering wheel into pockets 21 of the transfer
wheel 11 is enabled. Transfer wheel 11 is also provided with a vacuum chamber 20, providing suction to the pockets of the transfer wheel. Pockets 21 may accordingly also be provided with perforated bottom walls. Upon rotation of transfer wheel 11 the amounts of particles are transported between outer and inner stationary shoes 12, 13 to transfer location 200. The stationary shoes 12, 13 span over about a quarter of transfer wheel 11 between discharging location 100, where pockets of transfer wheel 11 are filled and transfer location 200, where the pockets are emptied. The inner stationary shoe 13 accommodates vacuum chamber 20. The outer stationary shoe 12 provides protection for the filled pockets 21. The vacuum provided to the pockets 21 in transfer wheel 11 is limited to the section of transfer wheel 11 between discharging location 100 and transfer location 200. At transfer location 200, the teeth 14, 1 of the toothed wheel engage one pocket 21 after the other of the transfer wheel. The teeth clear each pocket by transferring an amount of particles out of the pocket 21 and into the gas flow of delivery tube 17 by rotation of the toothed wheel in the same direction as the transfer wheel 11 (indicated by arrows). A delivery chamber 15 is provided at the transfer location 200 forming the initial portion of delivery tube 17. Upstream of delivery chamber 15 a gas valve 16 is arranged. Gas valve 16 is connected to a gas source (not shown) and may provide gas for the gas flow. The gas valve 16 may also be used to provide additional overpressure to delivery chamber 15 and delivery tube 17. Gas introduced via gas valve 16 may especially be used to adapt the speed of the particles in the gas flow to a linear speed of a material flow 22 the particles are to be introduced.

The gas flow in delivery tube 17 also flows tangential to transfer wheel 11 at transfer location 200. The speed of the gas flow is preferably also adaptable to the circumferential speed of the transfer wheel 11 and the toothed wheel 14, respectively, by corresponding synchronization means (not shown).

The invention has been described with reference to the embodiment shown in the drawings. However, further embodiments and variations may be envisaged without departing from the scope of the invention. By way of example only, the locations of discharge and transfer or the sizes of metering and transfer wheel
may be varied. Also arrangements of the wheels other than vertically rotatable may be chosen for one or all wheels and further wheels may be provided.
Claims

1. Method for introducing metered amounts of particles into a continuous flow of material, the method comprising the steps of
   - rotating a transfer wheel comprising a plurality of peripherally arranged pockets filled with a metered amount of particles,
   - applying suction from inside the transfer wheel to the pockets of the transfer wheel to hold the metered amount of particles inside the pockets of the transfer wheel,
   - relieving the suction and transferring the metered amount of particles from the pockets of the transfer wheel into a gas flow at a transfer location, the gas flow having a direction tangential to the transfer wheel at the transfer location, and
   - transporting the metered amounts of particles in the gas flow to the continuous flow of material.

2. Method according to claim 1, further comprising the step of introducing the metered amounts of particles into the continuous flow of material under an acute angle between 0 degrees and about 45 degrees.

3. Method according to claim 1 or 2, further comprising the step of adapting the speed of the metered amounts of particles in the gas flow to the speed of the continuous flow of material.

4. Method according to any one of the preceding claims, wherein the step of transferring the metered amount of particles from the pockets of the transfer wheel into the gas flow comprises rotating a toothed wheel, the teeth of the toothed wheel engaging the pockets of the transfer wheel thereby transferring the content of the pockets one at a time into the gas flow at the transfer location.
5. Method according to any one of the preceding claims, comprising the step of metering the amount of particles by rotating the transfer wheel containing the pockets past a filling chamber containing particles.

6. Method according to any one of claims 1 to 5, further comprising the steps of
- rotating a metering wheel comprising a plurality of peripherally arranged pockets past a filling chamber containing particles;
- applying suction from inside the metering wheel to the pockets of the metering wheel to draw particles from the filling chamber into the pockets of the metering wheel;
- relieving the suction to thereby enable the discharging of the particles from the pockets of the metering wheel into the pockets of the transfer wheel.

7. Method according to claim 5 or 6, further comprising the step of directing a gas flow through the filling chamber in order to assist in filling the pockets of the metering wheel or transfer wheel, respectively, with particles from the filling chamber.

8. Method according to any one of the preceding claims, further comprising the step of performing the introduction of metered amounts of particles into the continuous flow of material in a contactless manner.

9. Apparatus for introducing metered amounts of particles into a continuous flow of material, the apparatus comprising:
- a rotatable transfer wheel comprising a plurality of peripherally arranged pockets for accommodating metered amounts of particles,
- the transfer wheel comprising a vacuum manifold including a vacuum chamber for application of suction to the pockets for holding the metered amount of particles in the pockets of the transfer wheel,
a transfer element for transferring the metered amounts of particles from the pockets of the transfer wheel to a delivery tube, the delivery tube being arranged tangentially to the periphery of the transfer wheel,

- a gas flow device being in fluid communication with the delivery tube for providing a gas flow inside the delivery tube for transporting the amounts of metered particles to the continuous flow of material.

10. Apparatus according to claim 9, wherein the gas flow device comprises a gas application device and a flow control for adapting the gas flow in the delivery tube to a speed of the continuous flow of material.

11. Apparatus according to claim 9 or 10, wherein the transfer element for transferring the metered amounts of particles from the pockets of the transfer wheel to the delivery tube is a rotatable toothed wheel, the toothed wheel being arranged such that the teeth of the toothed wheel may engage the pockets of the transfer wheel upon rotation of the toothed wheel thereby transferring the content of one pocket at a time into the delivery tube.

12. Apparatus according to any one of claims 9 to 11, further comprising

- a rotatable metering wheel comprising a plurality of peripherally arranged pockets for metering and accommodating metered amounts of particles, the metering wheel comprising a vacuum manifold including a vacuum chamber for application of suction to the pockets of the metering wheel as the metering wheel rotates,

- a filling chamber for particles from which particles may be withdrawn into the pockets by the applied suction, and

- a transfer element for transferring the metered amounts of particles from the pockets of the metering wheel into the pockets of the transfer wheel.
13. Apparatus according to claim 12, wherein the filling chamber comprises a filling support element for supporting the filling of particles from the filling chamber into the pockets of the metering wheel.

14. Apparatus according to any one of claims 9 to 13, further comprising a synchronization unit for synchronizing the circumferential speed of the transfer wheel with a linear speed of the continuous flow of material.

15. Use of the method according to any one of claims 1 to 8 or of the apparatus according to any one of claims 9 to 14 in the manufacture of smoking articles or parts of smoking articles such as tobacco rods and filter elements.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

INV. A24C5/18 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)

A24C A24D B65B

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**

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<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>A</td>
<td>WO 2006/067629 Al (PHILIP MORRIS PROD [CH]) 29 June 2006 (2006-06-29) cited in the application on page 4, line 30 - page 7, line 5; figures -----</td>
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<td>A</td>
<td>WO 2011/033121 Al (BRITISH AMERICAN TOBACCO CO [GB]; KALJURA KARL [GB]; DAVIS ANDREW [GB]) 24 March 2011 (2011-03-24) page 3, line 9 - page 7, line 29; figures -----</td>
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<td>A</td>
<td>DE 10010176 Al (REEMTSMA H F &amp; PH [DE]) 13 September 2001 (2001-09-13) column 2, line 16 - column 4, line 33; figures -----</td>
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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) one of 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

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Date of the actual completion of the international search

21 February 2014

Date of mailing of the international search report

03/03/2014

Authorized officer

Marzano Monterosso

Form PCT/ISA2/210 (second sheet) (April 2005)
## DOCUMENTS CONSIDERED TO BE RELEVANT

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