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(54) APPARATUS AND METHOD FOR INTRODUCING OBJECTS INTO A SMOKING ARTICLE

VORRICHTUNG UND VERFAHREN ZUM EINFÜHREN VON GEGENSTÄNDEN IN EINEN RAUCHARTIKEL

APPAREIL ET PROCÉDÉ PERMETTANT D'INTRODUIRE DES OBJETS DANS UN ARTICLE POUR FUMEURS

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Description

[0001] The present invention relates to an apparatus and method for introducing objects into a continuous flow of material. For example, the objects may be beads or capsules which are to be introduced into a continuous flow of filter material during manufacture of the filter component of a smoking article.

[0002] Smoking articles, for example cigarettes, typically have a rod-shaped structure and include a charge, roll or column of smokable material such as cut tobacco. The cut tobacco is typically surrounded by a paper wrapper thereby forming a so-called "tobacco rod". In filter cigarettes a cylindrical filter element is aligned in an end-to-end relationship with the tobacco rod. By way of example, a filter element may comprise cellulose acetate tow filter material. The filter material may be circumscribed by a paper material known as "plug wrap". The filter element is typically attached to one end of the tobacco rod using circumscribing wrapping material known as "tipping paper".

[0003] Various proposed methods for modifying the sensory attributes of smoke involve using filter elements as vehicles for adding additional flavour to the mainstream smoke in the smoking article. For example, it has been suggested to introduce objects such as capsules into the filter material during manufacture of the filter elements.

[0004] Various methods and apparatuses have been suggested for introducing such objects into the filter material during manufacture of the filter elements for smoking articles. One such apparatus is described, for example, in WO 2010/055120. The apparatus described there comprises a reservoir containing the objects. The reservoir opens out into a transfer chamber in which the objects are circulated. The objects circulating in the transfer chamber move along a circulating path. A part of the circulating path extends along the peripheral surface of a rotatable transfer wheel. The rotatable transfer wheel has recesses (pockets) in its peripheral surface. The objects are introduced into and retained in the recesses with the aid of suction applied to the recesses. A rotatable brush is arranged in the transfer chamber at the end of that part of the circulating path which extends along the peripheral surface of the transfer wheel. By rotation of the transfer wheel the objects are transported to an insertion location where they are released from the transfer wheel and introduced into the continuous flow of filter material.

[0005] There is an ongoing need in the mass manufacture of filters to manufacture such filters as efficient and reliable as possible. This means, that there is a need for an apparatus that reliably places one capsule into each filter segment.

[0006] According to the present invention there is provided an apparatus and method for introducing objects into a continuous flow of material. While in the following specification only embodiments are illustrated in which objects are inserted into filter material, the invention also comprises cases in which the objects are inserted into other parts of a smoking article, for example into the tobacco rod or into a cavity in the filter.

[0007] The apparatus according to the invention comprises a reservoir for providing a plurality of objects, a rotatable transfer wheel for transporting and delivering the objects to an insertion unit for introducing the objects into the continuous flow of material, and a transfer chamber for transferring the objects to the rotatable transfer wheel. The transfer chamber is arranged between the reservoir and the rotatable transfer wheel. The apparatus according to the invention further comprises means for generating a circulating movement of the objects in the transfer chamber such that the objects move along a circulating path. A part of the circulating path extends along the peripheral surface of the rotatable transfer wheel and in the direction of rotation of the rotatable transfer wheel.

[0008] The means for generating the circulating movement comprise a return member which is arranged in the transfer chamber at a curved side wall portion of the transfer chamber. In particular, the return member is arranged at the end of that part of the circulating path which extends along the peripheral surface of the transfer wheel. The return member and the curved side wall portion of the transfer chamber are arranged to reverse the direction of movement of the objects in the transfer chamber. The return member has a drop-like shape comprising a peak, two straight flanks and a curved portion connecting the straight flanks. The peak faces towards the interior of the transfer chamber in a manner such that one of the flanks faces towards the peripheral surface of the rotatable transfer wheel, and this flank extends essentially tangential to the peripheral surface of the rotatable transfer wheel. The term "essentially tangential" means that this straight flank and a tangent to the peripheral surface at the point where a normal to the peripheral surface goes through the peak of the return member, run parallel or include an angle which may amount up to 15 degrees. In the case where the straight flank and the tangent include an angle. Preferably, the space between the straight flank and the peripheral surface tapers in a direction towards the end of that part of the circulating path that extends along the peripheral surface.

[0009] According to the invention, an object refers to any individual item that may be handled by the apparatus and method according to the invention. Preferably, the object is a substantially spherical object. Preferably, the substantially spherical object has a diameter of between about 0.5 mm and about 6.5 mm; more preferably, the substantially spherical object has a diameter of between about 2.5 mm and about 4.0 mm. Preferably, the substantially spherical object is a capsule. Preferably, the capsule comprises a liquid. Preferably, the liquid is flavorant, for example, menthol. Preferably, the capsule is crushable, that is, the capsule can release its content when a sufficient crushing strength is applied. With like objects, it is particularly important to handle the objects carefully as not to release the liquid within the capsules

during the manufacturing process.

[0010] The use of the return member thus advantageously separates the capsules moving in a first direction, substantially along the periphery of the transfer wheel from the capsules moving into the opposite direction back into the transfer chamber after not having been picked up by the transfer wheel. This separation allows for a better control of the speed of the capsules along the periphery of the transfer wheel. Further it reduces the stress onto the capsules, preventing breaking of capsules.

[0011] As the objects move along the peripheral surface of the rotatable transfer wheel some of the objects are transferred to the rotatable transfer wheel. By way of example, the rotatable transfer wheel may comprise recesses into which the objects are transferred through the application of suction to the bottom of the recesses. Usually, an excess number of objects moves along the peripheral surface of the rotatable transfer wheel in order to make sure that each of the recesses of the rotatable transfer wheel contain exactly one object. At the end of that part of the circulating path extending along the peripheral surface of the rotatable transfer wheel, the objects enter into the space between the flank of the return member and the peripheral surface of the rotatable transfer wheel. In case not all of the recesses of the rotatable transfer wheel already contain an object, the return member facilitates the entering of one object into any empty recess so that each recess of the transfer wheel contains an object as the recess leaves the zone of the transfer chamber. Those objects that have moved along the peripheral surface of the transfer wheel but have not been transferred to the rotatable transfer wheel are circulated back. For that purpose, during the further movement of the objects the direction of movement of the objects is reversed by the return member and the curved side wall portion of the transfer chamber. After having been circulated back, these objects can be used again for being transferred into the recesses of the rotatable transfer wheel. Also, circulating the objects in the transfer chamber advantageously prevents clogging.

[0012] In one embodiment of the apparatus according to the invention the straight flank facing towards the peripheral surface of the rotatable transfer wheel is arranged at a predetermined distance from the peripheral surface of the rotatable transfer wheel. This predetermined distance is selected such that a layer of one to six objects forms between the flank and the peripheral surface of the rotatable transfer wheel. In particular, the predetermined distance may be selected such that a layer of from two to four objects forms between the flank and the peripheral surface of the rotatable transfer wheel. This embodiment is advantageous in that it further contributes to the introduction of objects into the recesses in the peripheral surface of the rotatable transfer wheel, so that one object is retained in each recess of the rotatable transfer wheel as the respective recess leaves the zone of the transfer chamber.

[0013] In a further embodiment of the apparatus according to the invention, the straight flank is arranged such that the space between the straight flank and the peripheral surface of the rotatable transfer wheel tapers. Preferably, this tapering of the space occurs in a direction towards the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel. As mentioned above, a slight tapering of the space may assist in the transfer of objects into any potentially empty recesses of the rotatable transfer wheel. However, the tapering should only be to an extent such that the objects do not get damaged or broken. Preferably, the tapering is of the magnitude of less that about a quarter of the diameter of a capsule.

[0014] In a further embodiment of the apparatus according to the invention, the means for generating the circulating movement of the objects further comprise nozzles. These nozzles are arranged at the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel. The nozzles are capable of generating air flows which reverse the direction of movement of the objects in the transfer chamber. This reversal of movement of the objects is effected by the air flows together with the curved side wall portion of the transfer chamber, or together with the return member, or together with both the curved side wall portion and the return member.

[0015] While the speed of the objects may generally vary within a wide range, in accordance with one embodiment of the apparatus according to the invention the means for generating the circulating movement of the objects in the transfer chamber are designed such that, in operation, the speed of the objects along the peripheral surface of the rotatable transfer wheel is the same or substantially the same as the speed of the peripheral surface of the rotatable transfer wheel. The term "substantially the same" with respect to the speed of the objects in particular means, that the speed of the objects along the peripheral surface of the rotatable transfer wheel is within a range of about 25 percent slower to about 25 percent faster than the speed of the peripheral surface of the rotatable transfer wheel. More preferably, the speed of the objects varies from the speed of the peripheral surface of the rotatable transfer wheel within a range of about 10 percent slower to about 10 percent faster than the speed of the peripheral surface of the rotatable transfer wheel. Whenever the term "about" is used in this application in connection with a specific value, this always is intended to also disclose the specific value. This may further improve the transfer of objects from the transfer chamber to the recesses of the rotatable transfer wheel.

[0016] Another aspect of the invention relates to a method for introducing objects into a continuous flow of material. The method comprises the steps of:

providing a reservoir containing a plurality of objects;
introducing the objects from the reservoir to a trans-

fer chamber arranged between the reservoir and a rotatable transfer wheel; and

generating a circulating movement of the objects in the transfer chamber such that the objects move along a circulating path. A part of the circulating path extends along the peripheral surface of the rotatable transfer wheel, and in the direction of rotation of the rotatable transfer wheel (in operation).

[0017] The method further comprises the step of reversing the direction of movement of the objects in the transfer chamber by providing a return member. The return member is arranged in the transfer chamber at a curved side wall portion of the transfer chamber, and at the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel.

[0018] Still further, the method comprises the step of transferring the objects from the transfer chamber to the rotatable transfer wheel. The rotatable transfer wheel transports the transferred objects to an insertion location where the objects are introduced into the continuous flow of material.

[0019] Preferably, the return member has a drop-like shape, and comprises a peak, two straight flanks and a curved portion connecting the straight flanks. The peak faces towards the interior of the transfer chamber. The flank facing towards the peripheral surface of the rotatable transfer wheel extends essentially tangential to the peripheral surface of the rotatable transfer wheel.

[0020] The advantages of the method according to the invention correspond to those already discussed above in connection with the apparatus according to the invention. This holds, too, for the following embodiments of the method according to the invention.

[0021] Preferably, in one embodiment of the method according to the invention, the circulating movement of the objects in the transfer chamber is generated such that the speed of the objects moving along the peripheral surface of the rotatable transfer wheel is the same or substantially the same as the speed of the peripheral surface of the rotatable transfer wheel.

[0022] The term "substantially the same" with respect to the speed of the objects means in particular, that the speed of the objects may vary from the speed of the peripheral surface of the rotatable transfer wheel such that the speed of the objects is within a range of about 25 percent slower to about 25 percent faster than the speed of the peripheral surface of the rotatable transfer wheel.

[0023] More preferably, the speed of the objects is such that the speed of the objects is within a range of about 10 percent slower to about 10 percent faster than the speed of the peripheral surface of the rotatable transfer wheel.

[0024] Preferably, in still a further embodiment of the method according to the invention, the step of reversing the direction of movement of the objects in the transfer chamber further comprises providing additional air flow at that end of the circulating path which extends along the peripheral surface of the rotatable transfer wheel. The additional air flow is such that it reverses the direction of movement of the objects in the transfer chamber, either together with the curved side wall portion of the transfer chamber, or together with the return member, or together with both the curved side wall portion and the return member.

[0025] Further advantageous aspects become apparent from the following description of embodiments of the apparatus and method according to the invention with the aid of the drawings in which:

Fig. 1 shows a perspective view of an embodiment of essential components of the apparatus according to the invention;

Fig. 2 shows a view through the front plate of the apparatus of Fig. 1 showing some additional details,

Fig. 3 shows a detail of the transfer chamber with a return member being arranged therein to reverse the flow of objects through the transfer chamber.

[0026] In **Fig. 1** a perspective view of an embodiment of essential components of the apparatus according to the invention are shown in an assembled state. Fig. 2 shows a front view of this embodiment disclosing some additional details. As can be seen from Fig. 1 and Fig. 2, the apparatus comprises a reservoir 1 where the objects, for example capsules , are provided. A non-transparent front plate 10 of reservoir 1 can be seen in Fig. 1 while in Fig. 2 front plate 10 is shown to be transparent so that additional details of the apparatus are visible.

[0027] As can be seen in **Fig. 2**, the apparatus further comprises a transfer chamber 2 which is arranged between reservoir 1 and a rotatable transfer wheel 3. A return member 20 having a drop-like shape is arranged in transfer chamber 2. Return member 20 helps to reverse the movement of the capsules along the periphery of rotatable transfer wheel 3 in transfer chamber 20, as will be discussed in more detail further below.

[0028] A number of nozzles 100 are arranged in front wall 10. With the aid of nozzles 100, overpressure or suction can be applied in order to create a circulating movement of the capsules in transfer chamber 2. This is indicated in Fig. 2 by the arrows in transfer chamber 2. Also, the overpressure or suction applied through nozzles 100 assists the capsules in getting moved towards rotatable transfer wheel 3. Transfer chamber 2 is formed between a rear wall 11 and front wall 10. The depth of transfer chamber 2 between front wall 10 and rear wall 11 is such that only a single layer of capsules is allowed to form. By way of example, the depth ("thickness") of transfer chamber 2 may be in a range of about 110 percent to about 120 percent of the outer dimensions of the capsules. Additional nozzles (not shown) may be arranged in rear wall 11 in a position similar to the position

of nozzles 100 in front wall 10. Through these additional nozzles overpressure or suction can be applied in a similar manner as through nozzles 100, in order to create the circulating movement of the capsules in the transfer chamber 2. This further assists in movement of the capsules towards rotatable transfer wheel 3. During the movement of the capsules towards and along the periphery of rotatable transfer wheel 3 the capsules are sucked into recesses provided in the peripheral surface of rotatable transfer wheel 3 (the recesses not being visible in Fig. 1 and Fig. 2). This can be performed by applying suction through the bottom of the individual recesses provided in rotatable transfer wheel 3. Each capsule is retained in the respective recess until the capsule is introduced into a continuous flow of material at a unit for introducing the capsules into the continuous flow of material. The unit for introducing the capsules into the flow of material is not shown in the drawings and may be a conventional unit which is well-known in the art. By way of example, a suitable unit for introducing the capsules into a continuous flow of filter tow is shown in Figs. 10-12 of WO 2010/055120 and is described in detail in the corresponding parts of the specification thereof. The disclosure related to this unit for introducing the capsules into the continuous flow of filter material is therefore incorporated herein by reference. As can be seen in WO 2010/055120, the capsules are released from the recesses and introduced into the continuous flow of filter tow when the respective recess of the rotatable transfer wheel is at the lowermost position.

[0029] In **Fig. 3** a detail of transfer chamber 2 is represented showing return member 20 in more detail. Return member 20 is arranged in transfer chamber 2 at the end of that part of the circulating path of the capsules which extends along the peripheral surface of rotatable transfer wheel 3. Return member 20 has a drop-like shape comprising a peak 200, two straight flanks 201, and a curved portion 202 connecting the two straight flanks 201. Peak 200 faces towards the interior of transfer chamber 2. That flank 201 which faces towards the peripheral surface of rotatable transfer wheel 3 extends essentially tangential to the peripheral surface of rotatable transfer wheel 3 so as to allow the capsules to flow around return member 20. Thus, return member 20 assists in reversing the direction of movement of the capsules in transfer chamber 2.

[0030] Flank 201 of return member 20 facing towards the peripheral surface of rotatable transfer wheel 3 is arranged at a predetermined distance 204 from the peripheral surface of rotatable transfer wheel 3 (the peripheral surface of rotatable transfer wheel being indicated by dashed lines). Predetermined distance 204 is selected such that a layer of one to six capsules may form between flank 201 and the peripheral surface of rotatable transfer wheel 3. In particular, predetermined distance 204 can be selected such that a layer of from two to four capsules may form between flank 201 and the peripheral surface of rotatable transfer wheel 3. Return member 20 may be arranged such that the space between flank 201 and the peripheral surface of rotatable transfer wheel 3 tapers slightly. The space tapers in the direction towards the end of that part of the circulating path which extends along the peripheral surface of rotatable transfer wheel 3. This may cause a slight pressure on the capsules as they move through this space. This slight pressure may assist the insertion of the capsules into the recesses of rotatable transfer wheel 3. However, the tapering preferably is be selected such that the slight "pressure" produced through the said tapering cannot cause any damage or breaking of the capsules.

[0031] In addition, one or more nozzles 203 may be arranged at the end of the circulating path of the capsules along the peripheral surface of rotatable transfer wheel 3. Nozzles 203 are capable of generating air flows which reverse the direction of movement of the capsules in transfer chamber 2, together with either the curved side wall of transfer chamber 2, or together with return member 20, or together with both the curved side wall and return member 20, as this is indicated by the arrows represented in Fig. 3.

[0032] In operation, reservoir 1 is filled with capsules which enter into transfer chamber 2 at the lower end of reservoir 1 (see Fig. 1). In transfer chamber 2, a circulating movement of the capsules is generated, as is indicated by the arrows in Fig. 2. The capsules move along the peripheral surface of rotatable transfer wheel 3. Each of the recesses of rotatable transfer wheel 3 is filled with a capsule or bead due to suction being applied to the bottom of the respective recess. Those capsules not sucked into a recess are returned along the circulating path indicated by the arrows in Fig. 2 with the aid of return member 20 and nozzles 203. Those capsules sucked into a recess are transported by rotatable transfer wheel 3 to a unit for introducing the capsules into a continuous flow of filter material. There, the capsules are released from the recesses and introduced into the flow of filter material as this is described in detail in WO 2010/055120. During further rotation of rotatable transfer wheel 3, the respective empty recess again reaches the zone of transfer chamber 2 where a capsule or bead is sucked into the recess again, as this is described above.

[0033] The capsules are moving along the peripheral surface of rotatable transfer wheel 3 with a speed which is the same or substantially the same as the speed of the peripheral surface of rotatable transfer wheel 3. In particular, the speed of the capsules along the peripheral surface of rotatable transfer wheel 3 is within a range of about 25 percent slower to about 25 percent faster than the speed of the peripheral surface of rotatable transfer wheel 3. More preferably, the speed of the capsules is within a range of about 10 percent slower to about 10 percent faster than the speed of the peripheral surface of rotatable transfer wheel 3. A speed of movement of the capsules which is the same or substantially the same as the speed of the peripheral surface of rotatable transfer wheel 3 is advantageous in that it further improves

the transfer of capsules from transfer chamber 2 to the recesses of rotatable transfer wheel 3.

Claims

1. Apparatus for introducing objects into a continuous flow of material, comprising:

   - a reservoir (1) for providing a plurality of objects;
   - a rotatable transfer wheel (3) for transporting and delivering the objects to an insertion unit for introducing the objects into the continuous flow of material;
   - a transfer chamber (2) for transferring the objects to the rotatable transfer wheel (3), the transfer chamber (2) being arranged between the reservoir (1) and the rotatable transfer wheel (3),
   - means for generating a circulating movement of the objects in the transfer chamber (2) such that the objects move along a circulating path, a part of the circulating path extending along the peripheral surface of the rotatable transfer wheel (3) and in the direction of rotation of the rotatable transfer wheel (3),

   wherein the means for generating the circulating movement comprise a return member (20) which is arranged in the transfer chamber (2) at a curved side wall portion of the transfer chamber (2) at the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel (3), the return member (20) and the curved side wall portion being arranged to reverse the direction of movement of the objects in the transfer chamber (2), and wherein the return member (20) has a drop-like shape comprising a peak (200), two straight flanks (201) and a curved portion (202) connecting the straight flanks (201), the peak (200) facing towards the interior of the transfer chamber (2) in a manner such that the flank (201) facing towards the peripheral surface of the rotatable transfer wheel (3) extends essentially tangential to the peripheral surface of the rotatable transfer wheel (3).

2. Apparatus according to claim 1, wherein the straight flank (201) facing towards the peripheral surface of the rotatable transfer wheel (203) is arranged at a predetermined distance (204) from the peripheral surface of the rotatable transfer wheel (3), the predetermined distance (204) being selected such that a layer of one to six objects forms between the flank (201) and the peripheral surface of the rotatable transfer wheel (3).

3. Apparatus according to any one of the preceding claims, wherein the straight flank (201) extending essentially tangential to the peripheral surface of the rotatable transfer wheel (3) is arranged such that the space between the straight flank (201) and the peripheral surface of the rotatable transfer wheel (3) tapers in a direction towards the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel (3).

4. Apparatus according to any one of the preceding claims, wherein the means for generating the circulating movement of the objects further comprise nozzles (203) arranged at the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel (3), the nozzles (203) being capable of generating air flows which reverse the direction of movement of the objects in the transfer chamber (2) together with the curved side wall portion of the transfer chamber (2), or together with the return member (20), or together with both the curved side wall portion and the return member (20).

5. Apparatus according to any one of the preceding claims, wherein the means for generating the circulating movement of the objects in the transfer chamber (2) are designed such that the speed of the objects along the peripheral surface of the rotatable transfer wheel (3) is the same or substantially the same as the speed of the peripheral surface of the rotatable transfer wheel (3).

6. Apparatus according to claim 5, wherein the speed of the objects along the peripheral surface of the rotatable transfer wheel (3) varies from the speed of the peripheral surface of the rotatable transfer wheel (3) such that the speed of the objects is within a range of 25 percent slower to 25 percent faster than the speed of the peripheral surface of the rotatable transfer wheel (3).

7. Apparatus according to claim 6, wherein the speed of the objects along the peripheral surface of the rotatable transfer wheel (3) varies from the speed of the peripheral surface of the rotatable transfer wheel (3) such that the speed of the objects is within a range of 10 percent slower to 10 percent faster than the speed of the peripheral surface of the rotatable transfer wheel (3).

8. A method for introducing objects into a continuous flow of material, comprising the steps of:

   - providing a reservoir (1) containing a plurality of objects;
   - introducing the objects from the reservoir (1) to a transfer chamber (2) arranged between the

reservoir (1) and a rotatable transfer wheel (3);
- generating a circulating movement of the objects in the transfer chamber (2) such that the objects move along a circulating path, a part of the circulating path extending along the peripheral surface of the rotatable transfer wheel (3) and in the direction of rotation of the rotatable transfer wheel (3);
- reversing the direction of movement of the objects in the transfer chamber by providing a return member (20) which is arranged in the transfer chamber (2) at a curved side wall portion of the transfer chamber at the end of that part of the circulating path which extends along the peripheral surface of the rotatable transfer wheel (3),
- transferring the objects from the transfer chamber (2) to the rotatable transfer wheel (3), the rotatable transfer wheel (3) transporting the transferred objects to an insertion location where the objects are introduced into the continuous flow of material;
- introducing the objects into the continuous flow of material at the insertion location,
wherein the return member (20) has a drop-like shape comprising a peak (200), two straight flanks (201) and a curved portion (202) connecting the straight flanks (201), the peak (200) facing towards the interior of the transfer chamber (2) in a manner such that the flank (201) facing towards the peripheral surface of the rotatable transfer wheel (3) extends essentially tangential to the peripheral surface of the rotatable transfer wheel (3).

9. Method according to claim 8, wherein the step of generating a circulating movement of the objects in the transfer chamber (2) comprises generating a circulating movement of the objects which is such that the speed of the objects moving along the peripheral surface of the rotatable transfer wheel (3) is the same or substantially the same as the speed of the peripheral surface of the rotatable transfer wheel (3).

10. Method according to claim 9, wherein the speed of the objects moving along the peripheral surface of the rotatable transfer wheel (3) varies from the speed of the peripheral surface of the rotatable transfer wheel (3) such that the speed of the objects is within a range of 25 percent slower to 25 percent faster than the speed of the peripheral surface of the rotatable transfer wheel (3).

11. Method according to claim 10, wherein the speed of the objects moving along the peripheral surface of the rotatable transfer wheel (3) varies from the speed of the peripheral surface of the rotatable transfer wheel (3) such that the speed of the objects is within a range of 10 percent slower to 10 percent faster than the speed of the peripheral surface of the rotatable transfer wheel (3).

12. Method according to any one of claims 8 to 11, wherein the step of reversing the direction of movement of the objects in the transfer chamber (2) further comprises providing additional air flows at that end of the circulating path which extends along the peripheral surface of the rotatable transfer wheel (3), the additional air flows being such that they reverse the direction of movement of the objects in the transfer chamber (2) either together with the curved side wall portion of the transfer chamber or with the return member (20), or together with both the curved side wall portion and the return member (20).

Patentansprüche

1. Vorrichtung zum Einbringen von Objekten in einen kontinuierlichen Materialstrom, die Vorrichtung umfassend:

- einen Vorratsbehälter (1) zum Bereitstellen einer Vielzahl von Objekten;
- ein drehbares Transferrad (3) zum Transportieren und Zuführen der Objekte zu einer Einführeinheit zum Einbringen der Objekte in den kontinuierlichen Materialstrom;
- eine Transferkammer (2) zum Transferieren der Objekte zum drehbaren Transferrad (3), wobei die Transferkammer (2) zwischen dem Vorratsbehälter(1) und dem drehbaren Transferrad (3) angeordnet ist,
- Mittel zur Erzeugung einer zirkulierenden Bewegung der Objekte in der Transferkammer (2), derart, dass sich die Objekte entlang einer Umlaufbahn bewegen, wobei sich ein Teil der Umlaufbahn entlang der Umfangsfläche des drehbaren Transferrads (3) und in der Drehrichtung des drehbaren Transferrads (3) erstreckt,
wobei die Mittel zur Erzeugung der zirkulierenden Bewegung ein Umkehrelement (20) umfassen, welches in der Transferkammer (2) an einem gekrümmten Seitenwandabschnitt der Transferkammer (2) am Ende desjenigen Teils der Umlaufbahn angeordnet ist, der sich entlang der Umfangsfläche des drehbaren Transferrads (3) erstreckt, wobei das Umkehrelement (20) und der gekrümmte Seitenwandabschnitt so angeordnet sind, um die Bewegungsrichtung der Objekte in der Transferkammer (2) umzukehren,
und wobei das Umkehrelement (20) eine tropfenähnliche Form aufweist, die eine Spitze (200), zwei gerade Flanken (201) und einen, die geraden Flanken (201) verbindenden, ge-

krümmten Abschnitt (202) umfasst, wobei die Spitze (200) dem Innenraum der Transferkammer (2) derart zugewendet ist, dass sich die der Umfangsfläche des drehbaren Transferrads (3) zugewendete Flanke (201) im Wesentlichen tangential zur Umfangsfläche des drehbaren Transferrads (3) erstreckt.

2. Vorrichtung nach Anspruch 1, wobei die der Umfangsfläche des drehbaren Transferrads (3) zugewendete gerade Flanke (201) in einem vorbestimmten Abstand (204) zur Umfangsfläche des drehbaren Transferrads (3) angeordnet ist, wobei der vorbestimmte Abstand (204) derart gewählt ist, dass sich eine Schicht aus einem bis sechs Objekten zwischen der Flanke (201) und der Umfangsfläche des drehbaren Transferrads (3) ausbildet.

3. Vorrichtung nach einem der vorherigen Ansprüche, wobei die sich im Wesentlichen tangential zur Umfangsfläche des drehbaren Transferrads (3) angeordnete gerade Flanke (201) derart angeordnet ist, dass sich der Raum zwischen der geraden Flanke (201) und der Umfangsfläche des drehbaren Transferrads (3) in einer Richtung zum Ende desjenigen Teils der Umlaufbahn verjüngt, die sich entlang der Umfangsfläche des drehbaren Transferrads (3) erstreckt.

4. Vorrichtung nach einem der vorherigen Ansprüche, wobei die Mittel zur Erzeugung der zirkulierenden Bewegung der Objekte des Weiteren Düsen (203) umfassen, die am Ende desjenigen Teils der Umlaufbahn angeordnet sind, der sich entlang der Umfangsfläche des drehbaren Transferrads (3) erstreckt, wobei die Düsen (203) Luftströme zu erzeugen vermögen, welche, zusammen mit dem gekrümmten Seitenwandabschnitt der Transferkammer (2) oder zusammen mit dem Umkehrelement (20) oder zusammen mit dem gekrümmten Seitenwandabschnitt und dem Umkehrelement (20), die Bewegungsrichtung der Objekte in der Transferkammer (2) umkehren.

5. Vorrichtung nach einem der vorherigen Ansprüche, wobei die Mittel zur Erzeugung der zirkulierenden Bewegung der Objekte in der Transferkammer (2) derart ausgebildet sind, dass die Geschwindigkeit der Objekte entlang der Umfangsfläche des drehbaren Transferrads (3) dieselbe oder im Wesentlichen dieselbe wie die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

6. Vorrichtung nach Anspruch 5, wobei die Geschwindigkeit der Objekte entlang der Umfangsfläche des drehbaren Transferrads (3) gegenüber der Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) derart variiert, dass die Geschwindigkeit der Objekte innerhalb eines Bereichs von 25 Prozent langsamer bis 25 Prozent schneller als die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

7. Vorrichtung nach Anspruch 6, wobei die Geschwindigkeit der Objekte entlang der Umfangsfläche des drehbaren Transferrads (3) gegenüber der Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) derart variiert, dass die Geschwindigkeit der Objekte innerhalb eines Bereichs von 10 Prozent langsamer bis 10 Prozent schneller als die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

8. Verfahren zum Einbringen von Objekten in einen kontinuierlichen Materialstrom, welches Verfahren die folgenden Schritte umfasst:

- Bereitstellen eines Vorratsbehälters (1) beinhaltend eine Vielzahl von Objekten;
- Einbringen der Objekte vom Vorratsbehälter (1) zu einer zwischen dem Vorratsbehälter (1) und einem drehbaren Transferrad (3) angeordneten Transferkammer (2);
- Erzeugen einer zirkulierenden Bewegung der Objekte in der Transferkammer (2), derart, dass sich die Objekte entlang einer Umlaufbahn bewegen, wobei sich ein Teil der Umlaufbahn entlang der Umfangsfläche des drehbaren Transferrads (3) und in der Drehrichtung des drehbaren Transferrads (3) erstreckt;
- Umkehren der Bewegungsrichtung der Objekte in der Transferkammer durch Vorsehen eines Umkehrelements (20), welches in der Transferkammer (2) an einem gekrümmten Seitenwandabschnitt der Transferkammer am Ende desjenigen Teils der Umlaufbahn angeordnet ist, der sich entlang der Umfangsfläche des drehbaren Transferrads (3) erstreckt,
- Transferieren der Objekte von der Transferkammer (2) zum drehbaren Transferrad (3), wobei das drehbare Transferrad (3) die transferierten Objekte zu einer Einführstelle transportiert, an der die Objekte in den kontinuierlichen Materialstrom eingebracht werden;
- Einbringen der Objekte in den kontinuierlichen Materialstrom an der Einführstelle,

wobei das Umkehrelement (20) eine tropfenähnliche Form aufweist, umfassend eine Spitze (200), zwei gerade Flanken (201) und einen, die geraden Flanken (201) verbindenden, gekrümmten Abschnitt (202), wobei die Spitze (200) dem Innenraum der Transferkammer (2) derart zugewendet ist, dass die sich die der Umfangsfläche des drehbaren Transferrads (3) zugewendete Flanke (201) im Wesentlichen tangential zur Umfangsfläche des drehbaren

Transferrads (3) erstreckt.

9. Verfahren nach Anspruch 8, wobei der Schritt der Erzeugung einer zirkulierenden Bewegung der Objekte in der Transferkammer (2) Erzeugung einer zirkulierenden Bewegung der Objekte derart umfasst, dass die Geschwindigkeit der sich entlang der Umfangsfläche des drehbaren Transferrads (3) bewegenden Objekte dieselbe oder im Wesentlichen dieselbe wie die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

10. Verfahren nach Anspruch 9, wobei die Geschwindigkeit der sich entlang der Umfangsfläche des drehbaren Transferrads (3) bewegenden Objekte gegenüber der Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) derart variiert, dass die Geschwindigkeit der Objekte innerhalb eines Bereichs von 25 Prozent langsamer bis 25 Prozent schneller als die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

11. Verfahren nach Anspruch 10, wobei die Geschwindigkeit der sich entlang der Umfangsfläche des drehbaren Transferrads (3) bewegenden Objekte gegenüber der Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) derart variiert, dass die Geschwindigkeit der Objekte innerhalb eines Bereichs von 10 Prozent langsamer bis 10 Prozent schneller als die Geschwindigkeit der Umfangsfläche des drehbaren Transferrads (3) ist.

12. Verfahren nach einem der Ansprüche 8 bis 11, wobei der Schritt des Umkehrens der Bewegungsrichtung der Objekte in der Transferkammer (2) des Weiteren das Vorsehen zusätzlicher Luftströme an dem Ende des Teils der Umlaufbahn umfasst, der sich entlang der Umfangsfläche des drehbaren Transferrads (3) erstreckt, wobei die zusätzlichen Luftströme derart ausgebildet sind, dass sie die Bewegungsrichtung der Objekte in der Transferkammer (2) entweder zusammen mit dem gekrümmten Seitenwandabschnitt der Transferkammer oder mit dem Umkehrelement (20), oder zusammen mit dem gekrümmten Seitenwandabschnitt und dem Umkehrelement (20) umkehren.

Revendications

1. Appareil pour introduire d'objets dans un flux continu de matière, comprenant :

- un réservoir (1) pour pourvoir une pluralité d'objets ;
- une roue de transfert rotative (3) destinée à transporter et à distribuer les objets auprès d'une unité d'insertion servant à introduire les objets dans le flux continu de matière ;
- une chambre de transfert (2) destinée à transférer les objets auprès de la roue de transfert rotative (3), la chambre de transfert (2) étant disposée entre le réservoir (1) et la roue de transfert rotative (3),
- un moyen destiné à créer un mouvement de circulation des objets dans la chambre de transfert (2) de manière que les objets se déplacent le long d'une trajectoire de circulation, une portion de la trajectoire de circulation s'étendant le long de la surface périphérique de la roue de transfert rotative (3) et dans le sens de rotation de la roue de transfert rotative (3),

dans lequel le moyen destiné à créer le mouvement de circulation comprend un élément de renvois (20) qui est disposé dans la chambre de transfert (2) à une portion de paroi latérale courbée de la chambre de transfert (2) à l'extrémité de la portion de la trajectoire de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3), l'élément de renvois (20) et la portion de paroi latérale courbée étant disposés pour inverser le sens du mouvement des objets dans la chambre de transfert (2),

et dans lequel l'élément de renvois (20) présente une forme de goutte comprenant une pointe (200), deux flancs rectilignes (201) et une portion courbée (202) raccordant les flancs rectilignes (201), la pointe (200) étant tournée vers l'intérieur de la chambre de transfert (2) de manière que le flanc (201) faisant face à la surface périphérique de la roue de transfert rotative (3) s'étend de façon essentiellement tangentielle à la surface périphérique de la roue de transfert rotative (3).

2. Appareil selon la revendication 1, dans lequel le flanc rectiligne (201) faisant face à la surface périphérique de la roue de transfert rotative (203) est disposé à une distance prédéterminée (204) de la surface périphérique de la roue de transfert rotative (3), la distance prédéterminée (204) étant choisie de sorte qu'une couche d'un à six objets se forme entre le flanc (201) et la surface périphérique de la roue de transfert rotative (3).

3. Appareil selon l'une quelconque des revendications précédentes, dans lequel le flanc rectiligne (201), qui s'étend de façon essentiellement tangentielle à la surface périphérique de la roue de transfert rotative (3), est disposé de manière que l'espace séparant le flanc rectiligne (201) et la surface périphérique de la roue de transfert rotative (3) se rétrécisse en direction de l'extrémité de la portion de la trajectoire de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3).

4. Appareil selon l'une quelconque des revendications précédentes, dans lequel le moyen destiné à créer le mouvement de circulation des objets comprend en outre des buses (203) disposées à l'extrémité de la portion de la trajectoire de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3), les buses (203) étant aptes à générer des flux d'air qui inversent le sens de mouvement des objets dans la chambre de transfert (2) conjointement avec la portion de paroi latérale courbée de la chambre de transfert (2), ou conjointement avec l'élément de renvois (20), ou conjointement avec la portion de paroi latérale courbée et avec l'élément de renvois (20).

5. Appareil selon l'une quelconque des revendications précédentes, dans lequel le moyen destiné à créer le mouvement de circulation des objets dans la chambre de transfert (2) est conçu de manière que la vitesse des objets le long de la surface périphérique de la roue de transfert rotative (3) soit égale ou sensiblement égale à la vitesse de la surface périphérique de la roue de transfert rotative (3).

6. Appareil selon la revendication 5, dans lequel la vitesse des objets le long de la surface périphérique de la roue de transfert rotative (3) s'écarte de la vitesse de la surface périphérique de la roue de transfert rotative (3), de telle manière que la vitesse des objets est comprise dans une gamme allant de 25 pour cent plus lent à 25 pour cent plus rapide que la vitesse de la surface périphérique de la roue de transfert rotative (3).

7. Appareil selon la revendication 6, dans lequel la vitesse des objets le long de la surface périphérique de la roue de transfert rotative (3) s'écarte de la vitesse de la surface périphérique de la roue de transfert rotative (3), de telle manière que la vitesse des objets est comprise dans une gamme allant de 10 pour cent plus lent à 10 pour cent plus rapide que la vitesse de la surface périphérique de la roue de transfert rotative (3).

8. Procédé pour introduire d'objets dans un flux continu de matière, comprenant les étapes de :

- pourvoir un réservoir (1) contenant une pluralité d'objets ;
- introduire des objets du réservoir (1) dans une chambre de transfert (2) disposée entre le réservoir (1) et une roue de transfert rotative (3) ;
- générer un mouvement de circulation des objets dans la chambre de transfert (2) de manière que les objets se déplacent le long de la trajectoire de circulation, une portion de la trajectoire de circulation s'étendant le long de la surface périphérique de la roue de transfert rotative (3) et dans le sens de la rotation de la roue de transfert rotative (3) ;
- inverser le sens du mouvement des objets dans la chambre de transfert par pourvoir un élément de renvois (20) dans la chambre de transfert (2) à une portion de paroi latérale courbée de la chambre de transfert à l'extrémité de la portion de la trajectoire de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3) ;
- transférer les objets de la chambre de transfert (2) à la roue de transfert rotative (3), la roue de transfert rotative (3) transportant les objets transférés vers un emplacement d'insertion où les objets sont introduits dans le flux continu de matière ;
- introduire les objets dans le flux continu de matière au niveau de l'emplacement d'insertion ;

dans lequel l'élément de renvois (20) présente une forme de goutte comprenant une pointe (200), deux flancs rectilignes (201) et une portion courbée (202) raccordant les flancs rectilignes (201), la pointe (200) étant tournée vers l'intérieur de la chambre de transfert (2) de manière que le flanc (201) faisant face à la surface périphérique de la roue de transfert rotative (3) s'étende de façon essentiellement tangentielle à la surface périphérique de la roue de transfert rotative (3).

9. Procédé selon la revendication 8, dans lequel l'étape de générer un mouvement de circulation des objets dans la chambre de transfert (2) comprend générer un mouvement de circulation des objets qui est tel que la vitesse des objets se déplaçant le long de la surface périphérique de la roue de transfert rotative (3) est égale ou sensiblement égale à la vitesse de la surface périphérique de la roue de transfert rotative (3).

10. Procédé selon la revendication 9, dans lequel la vitesse des objets se déplaçant le long de la surface périphérique de la roue de transfert rotative (3) s'écarte de la vitesse de la surface périphérique de la roue de transfert rotative (3), de telle manière que la vitesse des objets est comprise dans une gamme allant de 25 pour cent plus lent à 25 pour cent plus rapide que la vitesse de la surface périphérique de la roue de transfert rotative (3).

11. Procédé selon la revendication 10, dans lequel la vitesse des objets se déplaçant le long de la surface périphérique de la roue de transfert rotative (3) s'écarte de la vitesse de la surface périphérique de la roue de transfert rotative (3), de telle manière que la vitesse des objets est comprise dans une gamme allant de 10 pour cent plus lent à 10 pour cent plus rapide que la vitesse de la surface périphérique de

la roue de transfert rotative (3).

12. Procédé selon l'une quelconque des revendications 8 à 11, dans lequel l'étape d'inverser le sens du mouvement des objets dans la chambre de transfert (2) comprend en outre pourvoir des flux d'air supplémentaires au niveau de l'extrémité de la trajectoire de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3), les flux d'air supplémentaires étant tels qu'ils inversent le sens du mouvement des objets dans la chambre de transfert (2) soit conjointement avec la portion de paroi latérale courbée de la chambre de transfert ou avec l'élément de renvois (20), ou conjointement avec la portion de paroi latérale courbée et avec l'élément de renvois (20).

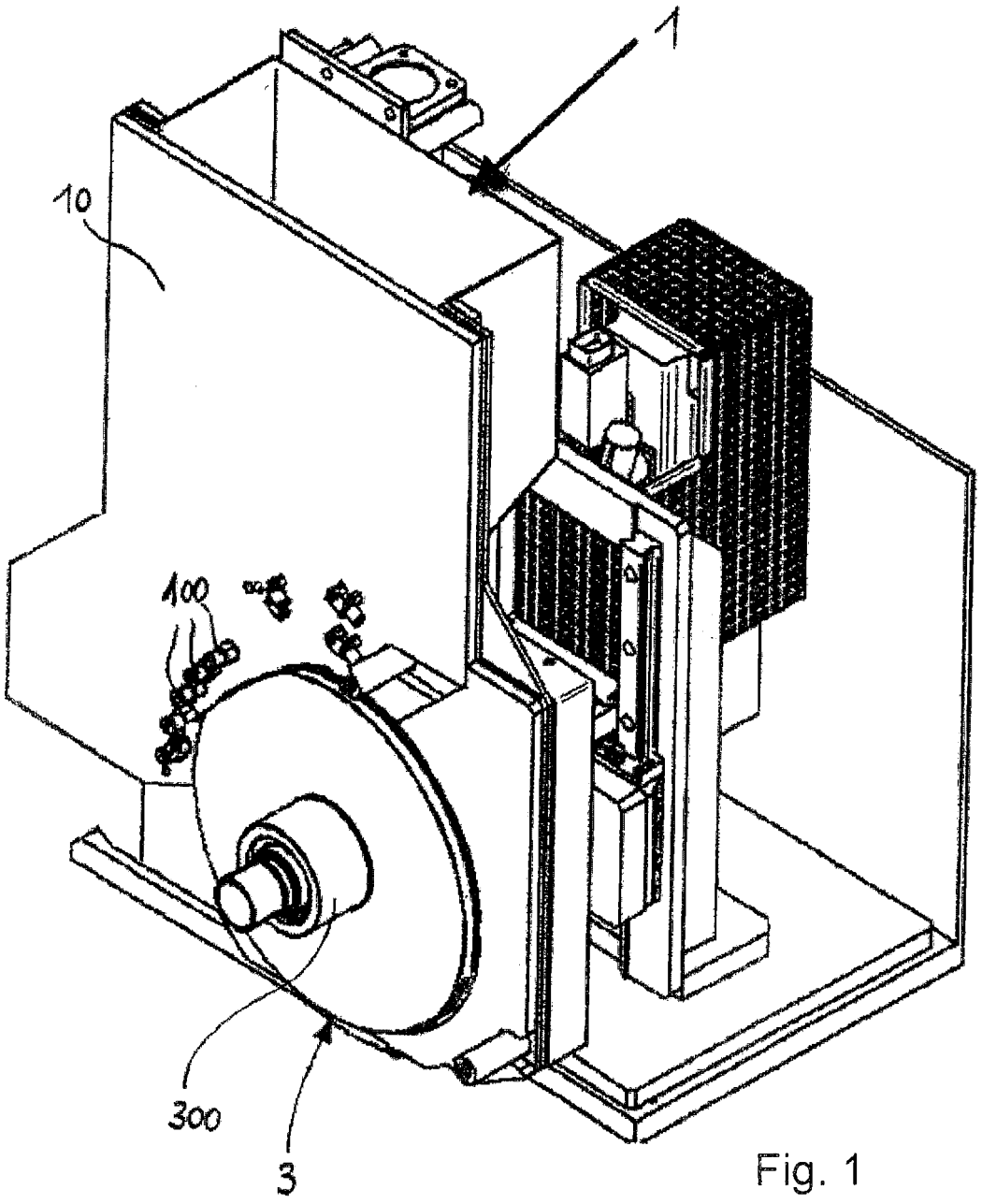

Fig. 1

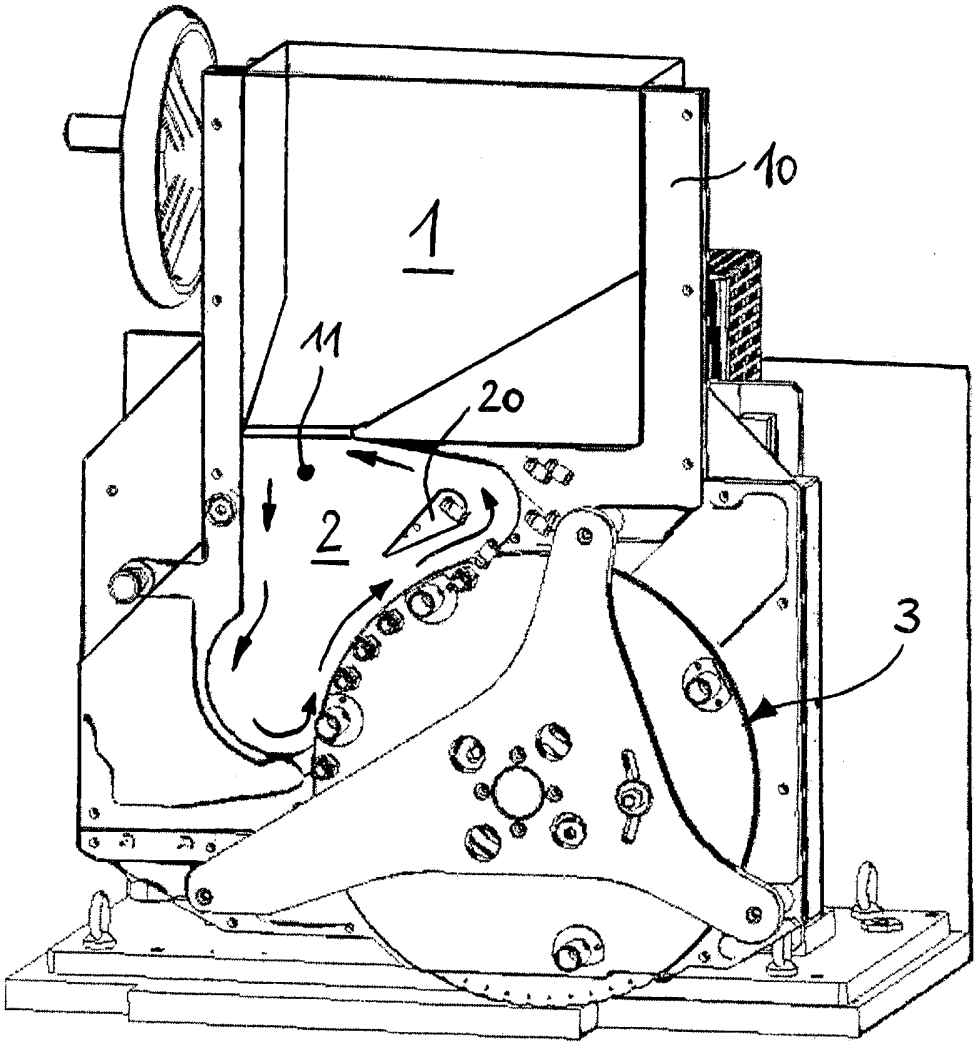

Fig. 2

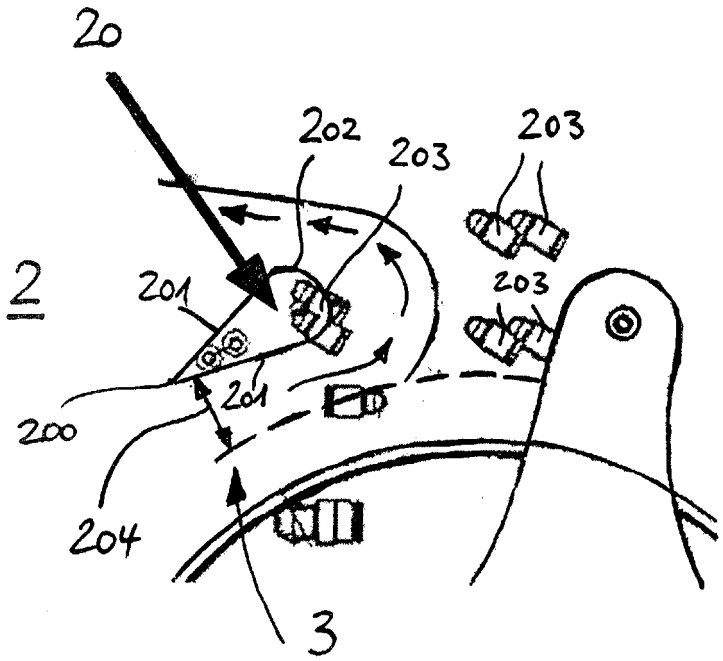

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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