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

VERFAHREN UND VORRICHTUNG ZUM EINFÜHREN VON GEGENSTÄNDEN IN EINEN RAUCHARTIKEL

PROCÉDÉ ET APPAREIL POUR INTRODUIRE DES OBJETS DANS UN ARTICLE À FUMER

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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 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 column of smokable material such as cut filler. The cut filler 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 incorporating additional elements into the filter 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-A-2010/055120. The apparatus according to the WO-A-2010/055120 comprises a reservoir containing the objects. The reservoir opens out into a transfer chamber in which, in operation, the objects are circulated. The objects circulating in the transfer chamber move along the peripheral surface of a rotatable transfer wheel. The transfer wheel has recesses (pockets) in its peripheral surface, and the objects are introduced into and retained in the recesses with the aid of suction applied to the recesses. 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 object into a filter element.

[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 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 rotatable transfer wheel is provided with recesses into which the objects can be transferred and in which the objects can be retained through the application of suction. The objects are retained in the recesses until the objects are delivered from the rotatable transfer wheel to the insertion unit for introducing the objects into the continuous flow of material. The rotatable transfer wheel comprises a suction inlet arranged in the center of the rotatable wheel such as to provide suction through the center of the rotatable wheel. The rotatable transfer wheel further comprises fluidic connections for providing a fluidic communication between the suction inlet and the recesses.

[0008] A "fluidic connection for providing fluidic communication" denotes any connection or part of a connection that allows the transmission of suction or overpressure from the suction inlet in or at the center of the rotatable transfer wheel to the recesses in the transfer wheel.

[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 arrangement of the suction inlet in the center of the rotatable transfer wheel and the fluidic connections for providing the fluidic communication between the suction inlet and the recesses allow for an easy supply of the suction at a single location (at the centrally arranged suction inlet such that suction is provided at least along a portion of the rotational axis of the rotatable transfer wheel). The suction is then "distributed" by the fluidic connections to the individual recesses of the rotatable transfer wheel. This is a simple and reliable solution from a constructional point of view, in particular when compared to the apparatuses known from the prior art. As becomes apparent from the embodiments described below, this constructional approach results in a variety of embodiments being conceivable which are simple from a constructional point of view. At the same time, these embodiments are highly reliable in particular at high speed of the transfer wheel, thus rendering the apparatus

according to the invention particularly effective.

[0011] In the apparatus according to the invention the rotatable transfer wheel comprises three adjacently arranged discs. The first disc of the three discs is a transfer disc comprising the recesses for receiving the objects from the transfer chamber. The second disc is a connection disc comprising at least a part of the fluidic connections between the suction inlet and the recesses. The third disc is a supply disc comprising the suction inlet arranged in the center of the supply disc. The connection disc is arranged in between the supply disc and the transfer disc. The constructional approach comprising the afore-mentioned three discs allows to essentially separate the functions "external suction supply at the center of the wheel", "distribution of the suction from the center of the wheel to the individual recesses", and "transport of the objects from the transfer chamber to the insertion unit". This separation of functions allows for further constructional options as becomes apparent in the following.

[0012] In one embodiment of the apparatus according to the invention, the suction inlet comprises a socket adapted to accommodate a connecting cylinder of a supply conduit. The connecting cylinder is provided with a bearing, for example a ball bearing or a sliding bearing. The bearing allows the rotatable wheel to rotate about the connecting cylinder. This embodiment represents an easy way to attach a suction supply line to the wheel. It is only necessary to connect the connecting cylinder to the supply disc. The entire rotatable wheel including the supply disc can then rotate about the bearing while the supply line is fixedly arranged in the socket.

[0013] In a further embodiment of the apparatus according to the invention, the fluidic connections further comprise transfer disc channels extending within the transfer disc. Each of the transfer disc channels comprises a respective radial channel portion extending substantially radially from the bottom of the respective recess towards a respective radial innermost end. A respective transverse channel portion extends from the respective radial innermost end of the radial channel portion to a respective orifice provided in that surface of the transfer disc facing the connection disc. The respective orifice and the respective transverse channel portion have a cross-section which is larger than the cross-section of the radial channel portion. This allows for a good "transmission" of the suction to the bottom of the respective recess. Accordingly, it enables to reliably suck the objects into the recesses and to retain them in the recesses during transport to the location where the objects are to be inserted into the flow of continuous material.

[0014] In one particular embodiment of such apparatus the orifices in the surface of the transfer disc are arranged at an activation diameter. The connection disc comprises a centrally arranged opening which is in fluidic communication with the suction inlet of the supply disc. The centrally arranged opening of the connection disc has a diameter which is smaller than the activation diameter. Accordingly, there is no direct fluidic communication between the centrally arranged opening of the connection disc and the orifices arranged in the surface of the transfer disc. The connection disc further comprises a plurality of connection channels extending radially from the centrally arranged opening at least to the activation diameter. The connection channels are in fluidic communication with a circumferential activation channel. The activation channel is provided on the surface of the connection disc that is facing the transfer disc. The activation channel has an open surface facing towards the transfer disc. The transfer disc forms a cover closing the open surface of the activation channel except at the locations of the orifices where the activation channel is in fluidic communication with the orifices. Thus, the suction can be reliably transmitted from the suction inlet through the connection channels into the activation channel, and from the activation channel through the orifices of the transfer disc and the transfer channels to the bottom of the recesses.

[0015] In a variant of this embodiment of the apparatus, the connection disc comprises a number of connection channels which is smaller than the number of orifices in the transfer disc. The connection channels are provided in that surface of the connection disc facing the supply disc. The connection channels have an open surface facing towards the supply disc. The supply disc forms a cover closing the open surfaces of the connection channels. Through-openings are provided which extend from the connection channels through the connection disc to the circumferential activation channel to establish a fluidic communication. By way of example, the connection channels extend from the central opening straight in the radial direction (star shaped) to the activation diameter. There, the through-openings may be arranged which connect the connecting channels with the circumferential activation channel on the other side of the connection disc. This is a simple constructional solution for "distributing" the centrally supplied suction to the individual orifices and from there to the respective recesses in the transfer disc.

[0016] In an alternative embodiment of the apparatus according to the invention, the orifices in the surface of the transfer disc are also arranged at an activation diameter. The connection disc comprises a centrally arranged opening which is in fluidic communication with the suction inlet of the supply disc. The centrally arranged opening has a diameter which is larger than the activation diameter. Accordingly, the centrally arranged opening of the connection disc is in direct fluidic communication with the orifices of the transfer disc. The centrally arranged opening of the connection disc is covered by the supply disc from one side and by the transfer disc from the other side. This embodiment is different from the afore-described embodiments, since it does not comprise the connection channels. Instead, the centrally arranged opening is in direct fluidic communication with the orifices of the transfer disc so as to directly transmit the suction. The supply disc and the transfer disc both cover the centrally arranged opening so that the suction can be securely trans-

mitted to the orifices of the transfer disc. This is an alternative simple constructional solution for "distributing" the centrally supplied suction to the individual orifices and from there to the respective recesses in the transfer disc.

[0017] A further embodiment of the apparatus according to the invention further comprises means for generating a circulating movement of the objects in the transfer chamber along a circulating path. A part of the circulating path extends along the peripheral surface of the rotatable transfer wheel in the direction of rotation of the rotatable transfer wheel. The circulating movement of the objects along the peripheral surface of the rotatable transfer wheel (or of the transfer disc, respectively) assists in making sure that an object is transferred into each of the recesses of the rotatable transfer wheel in order to avoid empty recesses. Also, circulating the objects in the transfer chamber prevents clogging within the transfer chamber. While the speed of the objects may generally vary within a wide range, preferably the speed of the objects along that part of the circulating path which extends 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 rotating transfer wheel. For example, the speed of the objects may vary from the speed of the peripheral surface of the rotatable transfer wheel 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 may vary 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 (including the case where the speed of the objects and the speed of the peripheral surface of the rotatable transfer wheel are substantially identical). Generally, when the term "about" is used in connection with a particular value it always is intended to include the exact value.

[0018] Another embodiment of the apparatus according to the invention further comprises a return member. The return member is arranged in the transfer chamber at a curved side wall portion of the transfer chamber. The curved side wall portion and the return member are arranged at the end of that part of the circulating path that extends along the peripheral surface of the rotatable transfer wheel. In particular, the return member is arranged in a manner such that the return member and the curved side wall portion reverse the direction of movement of the objects in the transfer chamber. Thus, the return member further improves the circulating movement of the objects in the transfer chamber.

[0019] In one embodiment of such apparatus, the return member has a drop-like shape. The drop-shaped return member comprises a peak, two substantially straight flanks and a curved portion connecting the flanks. The peak faces towards the interior of the transfer chamber. This facing towards the interior is in a manner such that the flank of the drop facing towards the peripheral surface of the rotatable transfer wheel extends essentially tangential to the peripheral surface of the rotatable transfer wheel. This may further improve the circulating movement of the objects in the transfer chamber. The term "substantially straight flanks" is meant to comprise straight flanks as well as flanks which are slightly curved. Preferably, the substantially straight flank facing the transfer wheel has a concave curvature. Preferably, the curvature of that flank substantially corresponds to the curvature of the transfer wheel, that is, the curvature of the flank is concentric with the transfer wheel.

[0020] In particular, the straight flank may be arranged such that the space between the straight flank and the peripheral surface of the rotatable transfer wheel 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. This may additionally assist the introduction of the objects into the recesses (pockets) of the transfer wheel. However, the space should only taper to an extent such that the objects do not get damaged or broken. Preferably, the tapering is of the magnitude of less than about a quarter of the diameter of a capsule.

[0021] In a further embodiment of the apparatus according to the invention, the substantially 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 substantially straight flank and the peripheral surface of the rotatable transfer wheel. In particular, the predetermined distance is selected such that a layer of two to four objects forms between the substantially straight flank and the peripheral surface of the rotatable transfer wheel. Preferably, the layer is one object deep such that the objects are stacked on top of each other in the transfer zone.

[0022] 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 an object is retained in each recess as the respective recess of the rotatable transfer wheel leaves the zone of the transfer chamber.

[0023] In a still further embodiment of the apparatus according to the invention the means for generating the circulating movement of the objects in the transfer chamber 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. These air flows, together with either the curved side wall portion of the transfer chamber or with the return member, or together with both the curved side wall portion and the return member, reverse the direction of movement of the objects in the transfer chamber. The nozzles still further improve the circulating movement of the objects in the transfer chamber.

[0024] 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 transfer chamber arranged between the reservoir and a rotatable transfer wheel, the rotatable transfer wheel having recesses; applying suction to the recesses of the rotatable transfer wheel thereby transferring the objects from the transfer chamber into the recesses of the rotatable transfer wheel and retaining the objects in the recesses;
transporting the objects retained in the recesses to an insertion location where the objects are to be introduced into the continuous flow of material; and
introducing the objects into the continuous flow of material at the insertion location.

The step of applying suction to the recesses of the rotatable transfer wheel is performed by applying suction through the center of the rotatable wheel through a suction inlet arranged in the center of the rotatable transfer wheel and through fluidic connections establishing a fluidic communication between the suction inlet and the recesses.

[0025] An embodiment of the method according to the invention further comprises the steps of:

generating a circulating movement of the objects in the transfer chamber such that at the peripheral surface of the rotatable transfer wheel the objects move along a circulating path extending in the direction of rotation of the rotatable transfer wheel;
in the transfer chamber, at the end of the circulating path of the objects along the peripheral surface of the rotatable transfer wheel, providing a return member to reverse the direction of movement of the objects in the transfer chamber, the return member having a drop-like shape comprising a peak, two straight flanks and a curved portion connecting the straight flanks, with the peak facing towards the interior of the transfer chamber in a manner such that the flank of the drop facing towards the peripheral surface of the rotatable transfer wheel extends essentially tangential to the peripheral surface of the rotatable transfer wheel.

[0026] The advantages of the embodiments of the methods are identical to the advantages already mentioned above with respect to the corresponding embodiments of the apparatus according to the invention.

[0027] 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 an enlarged cross-sectional view of the central portion of an embodiment of the rotatable transfer wheel comprising a supply disc, a connection disc and a transfer disc, with a connecting cylinder of a central supply conduit being connected to the socket of the supply disc;

Fig. 4 shows an exploded view of an embodiment of the rotatable transfer wheel showing some details of the transfer disc and of the connection disc;

Fig. 5 shows a first embodiment of the connection disc of the rotatable transfer wheel in front of the transfer disc;

Fig. 6 shows a second embodiment of the connection disc of the rotatable transfer wheel in front of the transfer disc;

Fig. 7 shows a third embodiment of the connection disc of the rotatable transfer wheel in front of the transfer disc; and

Fig. 8 shows a detail of the transfer chamber with a return member being arranged therein to reverse the flow of objects through the transfer chamber.

[0028] 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, while 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 or beads to be introduced in the continuous flow of material, 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.

[0029] 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.

[0030] 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 as this is indicated in Fig. 2 by the arrows in the transfer chamber 2, and in order to assist 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 one layer of capsules is allowed to form. By way of example, the depth ("thick-

ness") of transfer chamber 2 may be in a range of about 110 percent to about 120 percent of the outer dimensions of the capsules or beads. 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 transfer chamber 2, and in order to assist the movement of the capsules towards the peripheral surface of rotatable transfer wheel 3. During the movement of the capsules towards and along the peripheral surface 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 is performed by applying suction through the bottom of the individual recesses in order to suck one capsule into each recess, where the capsule is retained until the capsule is introduced into a continuous flow of material, for example into filter tow. This introduction of the capsule is performed by a unit for introducing the capsules into a continuous flow of material. The unit for introducing the capsules into the filter tow 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 the 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 201/055120, the capsules are introduced into the continuous flow of filter tow when the respective recess of the rotatable transfer wheel is at the lowermost position.

[0031] **Fig. 3** shows an enlarged cross-sectional view of the central portion of an embodiment of rotatable transfer wheel 3. Rotatable transfer wheel 3 comprises a supply disc 30, a connection disc 31 and a transfer disc 32. A connecting cylinder 40 of a central supply conduit 4 is connected to socket 300 of supply disc 30. Socket 300 forms the suction inlet and is adapted to accommodate connecting cylinder 40. Connecting cylinder 40 is provided with a ball bearing 400. Ball bearing 400 allows rotatable transfer wheel 3 to rotate about connecting cylinder 40 while suction can be centrally supplied to rotatable wheel 3 through supply conduit 4. An O-ring 301 is arranged in a groove 302 provided in supply disc 30 to surround the innermost end of connecting cylinder 40, so that the suction supplied through conduit 4 and through connecting cylinder 40 is applied to a central opening 310 provided in connection disc 31. Connection disc 31 "distributes" the suction radially outwardly to transfer disc channels provided in transfer disc 32. These transfer disc channels lead to the respective bottoms of the recesses in which the beads are retained.

[0032] **Fig. 4** shows an exploded schematic view of an embodiment of rotatable transfer wheel 3 comprising supply disc 30, connection disc 31 and transfer disc 32. While supply disc 30 is only shown schematically, some details of connection disc 31 and of transfer disc 32 are shown in Fig. 4. In particular, it can be seen from Fig. 4 that transfer disc 32 comprises recesses 320 into which the capsules are sucked from transfer chamber 2. The capsules are retained in recesses 320 during their transport to the unit for introducing the capsules into the continuous flow of filter tow. From the bottom of the respective recess 320 a transfer disc channel 321 extends. Transfer disc channel 321 comprises a radial channel portion 322 that extends radially towards an innermost end. From this innermost end of radial channel portion 322 a transverse channel portion 323 extends to an orifice 324 provided in the surface 325 of transfer disc 32 facing connection disc 31. Orifices 324 are circularly arranged at an activation diameter 326.

[0033] In the following, further details of Fig. 4 will be explained in connection with the embodiment of connection disc 31 shown in **Fig. 5.** Connection disc 31 comprises a centrally arranged opening 310 (see Fig. 5) having an inner diameter 311 (see also Fig. 5) which is smaller than activation diameter 326. Accordingly, centrally arranged opening 310 is not in direct fluidic communication with orifices 324 of transfer disc 32. A plurality of connection channels 312 extend radially outwardly from centrally arranged opening 310 (see Fig. 5) to activation diameter 326 (see Fig. 4) or a little bit further outwardly than activation diameter 326. Connection channels 312 are provided in the surface of connection disc 31 that faces supply disc 30. Connection channels 312 have an open surface facing towards supply disc 30. When mounted, supply disc 30 covers connection channels 312 and closes the open surfaces of connection channels 312 so as to form substantially fluid-tight channels.

[0034] On the surface facing transfer disc 32, connection disc 31 comprises a circumferential activation channel 314. Activation channel 314 is arranged at activation diameter 326 and has an open surface facing towards transfer disc 32. Activation channel 314 provided on the surface facing transfer disc 32 and connection channels 312 provided on the surface facing supply disc 30 are connected by through-openings 313. When being mounted, transfer disc 32 closes the open surface of circumferential activation channel 314 except at the locations of orifices 324.

[0035] Thus, a fluidic communication between the suction inlet and recesses 320 is established via centrally arranged opening 310, connecting channels 312, through-openings 313, activation channel 314, orifices 324 and transfer disc channel 321.

[0036] **Fig. 6** shows a second embodiment of a connection disc 34. This embodiment of connection disc 34 is to some extent similar to the embodiment of connection disc 31 shown in Fig. 5. Connection disc 34 has a centrally arranged opening 340 which has an inner diameter 341 smaller than the activation diameter 326 (see Fig. 4). Connection disc 34 comprises connection channels 342

which are wider than the connection channels 312 of connection disc 31. Connections channels 342 again have an open surface facing towards supply disc 30 (not shown in Fig. 6). When being mounted, supply disc 30 covers channels 342 and closes the open surfaces of connection channels 342, so that substantially fluid-tight channels are formed. Through-openings 343 are provided to connect connection channels 342 and the activation channel. The activation channel is not visible in Fig. 6, but is arranged as shown in Fig. 4. Some of the orifices 324 of transfer disc 32 are visible through the through-openings 343 of connection disc 34. The suction is transmitted in a similar manner as in the embodiment shown in Fig. 5 and described above in connection with Fig. 4 and Fig. 5, so that it is not described again here.

[0037] In **Fig. 7** a third embodiment of a connection disc 35 is shown. In this embodiment of connection disc 35, the centrally arranged opening 350 has an inner diameter 351 which is larger than the activation diameter 326 (see Fig. 4). Consequently, no connection channels are present in this embodiment of connection disc 35. Orifices 324 of transfer disc 32 are visible in Fig. 7. When being mounted, centrally arranged opening 350 is covered from one side by supply disc 30 and from the other side by transfer disc 32 in a substantially fluid-tight manner. Thus, suction applied through centrally arranged opening 350 is directly transmitted to orifices 324 and from there through transfer channels 321 to recesses 320 (see also Fig. 4).

[0038] In **Fig. 8** 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 flanks 201, and a curved portion 202 connecting the two 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 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.

[0039] 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. 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 forms between flank 201 and the peripheral surface of rotatable transfer wheel 3. As can also be seen, 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 along the circulating path. This slight pressure may assist the insertion of the capsules into the recesses 320 of rotatable transfer wheel 3. However, the tapering must be selected such that the slight "pressure" produced through the said tapering cannot cause any damage or breaking of the capsules or beads.

[0040] 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 (or transfer disc 32, respectively). Nozzles 203 are capable of transmitting air flows which reverse the direction of movement of the capsules in the 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. 8.

[0041] In operation, reservoir 1 is filled with capsules which enter under the influence of gravity 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 320 is filled with a capsule due to suction being applied to the bottom of the respective recess 320. Those capsules not sucked into a re-cess 320 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 320 are transported by rotatable transfer wheel 3 to a unit for introducing the capsules beads into a continuous flow of filter material. At that position the capsules are released from the recesses 320 and introduced into the filter material, as described in detail in WO-A-2010/055120. During further rotation of rotatable transfer wheel 3, an empty recess 320 again reaches the zone of transfer chamber 2 where a capsule is sucked into recess 320 again, as described above.

[0042] 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 25 percent slower to 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 10 percent slower to 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, since it further improves the transfer of capsules from transfer chamber 2 to recesses 320 of rotatable transfer wheel 3 due to the substantial synchronization of the capsule speed and the transfer wheel speed.

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 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),

   wherein the rotatable transfer wheel (3) is provided with recesses (320) into which the objects can be transferred and in which the objects can be retained through the application of suction until the objects are delivered from the rotatable transfer wheel (3) to the insertion unit for introducing the objects into the continuous flow of material,
   wherein the rotatable transfer wheel (3) comprises a suction inlet arranged in the center of the rotatable transfer wheel (3) such as to provide suction through the center of the rotatable wheel (3) and comprising fluidic connections for providing a fluidic communication between the suction inlet and the recesses (320),
   characterized in that the rotatable transfer wheel (3) comprises three adjacently arranged discs (30,31,32;34,35), a transfer disc (32) comprising the recesses (320) for receiving the objects from the transfer chamber (2), a connection disc (31 ;34;35) comprising at least a part of the fluidic connections between the suction inlet and the recesses (320), and a supply disc (30) comprising the suction inlet arranged in the center of the supply disc (30), the connection disc (31 ;34;35) being arranged in between the supply disc (30) and the transfer disc (32).

2. Apparatus according to claim 1, wherein the suction inlet comprises a socket (300) adapted to accommodate a connecting cylinder (40) of a supply conduit (4), the connecting cylinder (40) being provided with a bearing (400), the bearing (400) allowing the rotatable wheel (3;30,31,32;34,35) to rotate about the connecting cylinder (40).

3. Apparatus according to claim 1 or claim 2, wherein the fluidic connections further comprise transfer disc channels (321) extending within the transfer disc (32), each of the transfer disc channels (321) comprising a respective radial channel portion (322) extending radially inwardly from the bottom of the respective recess (320) towards a respective radial innermost end and a respective transverse channel portion (323) extending from the respective radial innermost end of the radial channel portion (322) to a respective orifice (324) provided in that surface (325) of the transfer disc (32) facing the connection disc (31;34;35), the respective orifice (324) and the respective transverse channel portion (323) having a cross-section which is larger than the cross-section of the radial channel portion (322).

4. Apparatus according to claim 3, wherein the orifices (324) in the surface (325) of the transfer disc (32) are arranged at an activation diameter (326), and wherein the connection disc (31;34) comprises a centrally arranged opening (310;340) which is in fluidic communication with the suction inlet of the supply disc (30), the centrally arranged opening (310;340) of the connection disc (31;34) having a diameter (311;341) which is smaller than the activation diameter (326), and wherein the connection disc (31 ;34) further comprises a plurality of connection channels (312; 342) extending radially outwardly from the centrally arranged opening (310;340) to the activation diameter and being in fluidic communication with a circumferential activation channel (314), the activation channel (314) being provided at the activation diameter on that surface of the connection disc facing the transfer disc (32), the activation channel (314) having an open surface facing towards the transfer disc (32), the transfer disc (32) forming a cover closing the open surface of the activation channel (314) except at the locations of the orifices (324) where the activation channel (314) is in fluidic communication with the orifices (324).

5. Apparatus according to claim 4, wherein the connection disc (31; 34) comprises a number of connection channels (312;342) which is smaller than the number of orifices (324) in the transfer disc (32), wherein the connection channels (312;342) are provided in that surface of the connection disc (31;34) facing the supply disc (30), the connection channels (312;342) having an open surface facing towards the supply disc (30) with the supply disc (30) forming a cover closing the open surfaces of the connection channels (312;342), and wherein through-openings (313;343) are provided which extend from the connection channels (312;342) through the connection disc (31;34) to the circumferential activation channel (314) to establish the fluidic communication of the connection channels (312;342) with the circumferential activation channel (314).

6. Apparatus according to claim 3, wherein the orifices (324) in the surface of the transfer disc (32) are arranged at an activation diameter (326), wherein the connection disc (35) comprises a centrally arranged opening (350) which is in fluidic communication with the suction inlet of the supply disc (30), and wherein

the centrally arranged opening (350) has a diameter (351) which is larger than the activation diameter, so that the centrally arranged opening (350) of the connection disc (35) is in direct fluidic communication with the orifices (324) of the transfer disc (32), the centrally arranged opening (350) of the connection disc (35) being covered by the supply disc (30) from one side and by the transfer disc (32) from the other side.

7. Apparatus according to any one of the preceding claims, further comprising means for generating a circulating movement of the objects in the transfer chamber (2) along a circulating path, a part of the circulating path extending along the peripheral surface of the rotatable transfer wheel (3) in the direction of rotation of the rotatable transfer wheel (3).

8. Apparatus according to claim 7, further comprising a return member (20) which is arranged in the transfer chamber (2) at a curved side wall portion of the transfer chamber (2), the curved side wall portion and the return member (20) being arranged at the end of that part of the circulating path extending along the peripheral surface of the rotatable transfer wheel (3) in a manner such that the return member (20) and the curved side wall portion reverse the direction of movement of the objects in the transfer chamber (2).

9. Apparatus according to claim 8, wherein the return member (20) has a drop-like shape comprising a peak (200), two substantially straight flanks (201) and a curved portion (202) connecting the substantially straight flanks (201), with the peak (200) facing towards the interior of the transfer chamber (2) in a manner such that the flank (201) of the drop facing towards the peripheral surface of the rotatable transfer wheel (3) extends essentially tangential to the peripheral surface of the rotatable transfer wheel (3).

10. Apparatus according to claim 9, 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), in particular a layer of two to four objects.

11. Apparatus according to any one of claims 7 to 10, wherein the means for generating the circulating movement of the objects in the transfer chamber (2) 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), said nozzles (203) being capable of generating air flows which, together with either the curved side wall portion of the transfer chamber (2) or with the return member (20), or together with both the curved side wall portion of the transfer chamber (2) and the return member (20), reverse the direction of movement of the objects in the transfer chamber (2).

12. 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), the rotatable transfer wheel (3) having recesses (320);
- applying suction to the recesses (320) of the rotatable transfer wheel (3) thereby transferring the objects from the transfer chamber (2) into the recesses (320) of the rotatable transfer wheel (3) and retaining the objects in the recesses (320);
- transporting the objects retained in the recesses (320) to an insertion location where the objects are to be introduced into the continuous flow of material;
- introducing the objects into the continuous flow of material at the insertion location, wherein applying suction to the recesses (320) of the rotatable transfer wheel (3) is performed by applying suction through the center of the rotatable transfer wheel (3) through a suction inlet arranged in the center of the rotatable transfer wheel (3) and through fluidic connections establishing a fluidic communication between the suction inlet and the recesses (320),

characterized in that the step of providing a transfer wheel comprises providing three adjacently arranged discs (30,31,32;34,35), a transfer disc (32) comprising the recesses (320) for receiving the objects from the transfer chamber (2), a connection disc (31 ;34;35) comprising at least a part of the fluidic connections between the suction inlet and the recesses (320), and a supply disc (30) comprising the suction inlet arranged in the center of the supply disc (30), the connection disc (31 ;34;35) being arranged in between the supply disc (30) and the transfer disc (32).

13. Method according to claim 12, further comprising the step of generating a circulating movement of the objects in the transfer chamber (2) along a circulating path, a part of the circulating path extending along the peripheral surface of the rotatable transfer wheel (3) in the direction of rotation of the rotatable transfer

wheel (3).

Patentansprüche

1. Vorrichtung zum Einbringen von Gegenständen in einen kontinuierlichen Materialstrom, aufweisend:

   - einen Vorratsbehälter (1) zum Bereitstellen von mehreren Gegenständen;
   - ein drehbares Übergaberad (3) zum Transportieren der Gegenstände zu einer Einführeinheit zum Einbringen der Gegenstände in den kontinuierlichen Materialstrom;
   - eine Übergabekammer (2) zum Übergeben der Gegenstände auf das drehbare Übergaberad (3), wobei die Übergabekammer (2) zwischen dem Vorratsbehälter(1) und dem drehbaren Übergaberad (3) angeordnet ist,

   wobei das drehbare Übergaberad (3) mit Aussparungen (320) ausgestattet ist, in die die Gegenstände übergeben werden und in denen die Gegenstände durch die Anwendung von Saugwirkung zurückgehalten werden können, bis die Gegenstände vom drehbaren Übergaberad (3) der Einführeinheit zum Einbringen der Gegenstände in den kontinuierlichen Materialstrom zugeführt werden,
   wobei das drehbare Übergaberad (3) einen in der Mitte des drehbaren Übergaberads (3) angeordneten Saugeinlass aufweist, um eine Saugwirkung durch die Mitte des drehbaren Rades (3) bereitzustellen, und fluidische Verbindungen zum Bereitstellen einer Fluidverbindung zwischen dem Saugeinlass und den Aussparungen (320) aufweist,
   dadurch gekennzeichnet, dass das drehbare Übergaberad (3) drei angrenzend angeordnete Scheiben (30, 31, 32; 34, 35) aufweist, eine Übergabescheibe (32) aufweist, welche die Aussparungen (320) zum Aufnehmen der Gegenstände von der Übergabekammer (2) aufweist, eine Verbindungsscheibe (31; 34; 35) aufweist, die mindestens einen Teil der fluidischen Verbindungen zwischen dem Saugeinlass und den Aussparungen (320) aufweist, und eine Versorgungsscheibe (30) aufweist, die den in der Mitte der Versorgungsscheibe (30) angeordneten Saugeinlass aufweist, wobei die Verbindungsscheibe (31; 34; 35) zwischen der Versorgungsscheibe (30) und der Übergabescheibe (32) angeordnet ist.

2. Vorrichtung nach Anspruch 1, wobei der Saugeinlass einen Sockel (300) aufweist, der ausgeführt ist, um einen Verbindungszylinder (40) einer Versorgungsleitung (4) aufzunehmen, wobei der Verbindungszylinder (40) mit einem Lager (400) ausgestattet ist und das Lager (400) dem drehbaren Rad (3; 30, 31, 32; 34, 35) ermöglicht, sich um den Verbindungszylinder (40) zu drehen.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei die fluidischen Verbindungen des Weiteren Übergabescheibenkanäle (321) aufweisen, die sich innerhalb der Übergabescheibe (32) erstrecken, wobei jeder der Übergabescheibenkanäle (321) einen entsprechenden radialen Kanalabschnitt (322) aufweist, der sich radial nach innen von der Unterseite der entsprechenden Aussparung (320) zu einem entsprechenden radialen innersten Ende erstreckt, und einen entsprechenden transversalen Kanalabschnitt (323) aufweist, der sich von dem entsprechenden radialen innersten Ende des radialen Kanalabschnitts (322) zu einer entsprechenden Durchflussöffnung (324) erstreckt, die in derjenigen Fläche (325) der Übergabescheibe (32) vorgesehen ist, die der Verbindungsscheibe (31; 34; 35) gegenübersteht, wobei die entsprechende Durchflussöffnung (324) und der entsprechende transversale Kanalabschnitt (323) einen Querschnitt aufweisen, der grösser ist als der Querschnitt des radialen Kanalabschnitts (322).

4. Vorrichtung nach Anspruch 3, wobei die Durchflussöffnungen (324) in der Fläche (325) der Übergabescheibe (32) an einem Aktivierungsdurchmesser (326) angeordnet sind, und wobei die Verbindungsscheibe (31; 34) eine zentral angeordnete Öffnung (310; 340) aufweist, die in Fluidverbindung mit dem Saugeinlass der Versorgungsscheibe (30) steht, wobei die zentral angeordnete Öffnung (310; 340) der Verbindungsscheibe (31; 34) einen Durchmesser (311; 341) aufweist, der kleiner ist als der Aktivierungsdurchmesser (326), und wobei die Verbindungsscheibe (31; 34) des weiteren mehrere Verbindungskanäle (312; 342) aufweist, die sich von der zentral angeordneten Öffnung (310; 340) radial nach aussen zum Aktivierungsdurchmesser erstrecken und in Fluidverbindung mit einem umlaufenden Aktivierungskanal (314) stehen, wobei der Aktivierungskanal (314) am Aktivierungsdurchmesser auf derjenigen Fläche der Verbindungsscheibe vorgesehen ist, die der Übergabescheibe (32) gegenübersteht, wobei der Aktivierungskanal (314) eine offene Fläche aufweist, die zur Übergabescheibe (32) zeigt, und die Übergabescheibe (32) eine Abdeckung bildet, welche die offene Fläche des Aktivierungskanals (314) ausser an den Orten der Durchflussöffnungen (324) an denen der Aktivierungskanal (314) in Fluidverbindung mit den Durchflussöffnungen (324) steht, abdeckt.

5. Vorrichtung nach Anspruch 4, wobei die Verbindungsscheibe (31; 34) eine Anzahl von Verbindungskanälen (312; 342) aufweist, die kleiner als die Anzahl an Durchflussöffnungen (324) in der Übergabescheibe (32) ist, wobei die Verbindungskanäle

(312; 342) in derjenigen Fläche der Verbindungsscheibe (31; 34) vorgesehen sind, die der Versorgungsscheibe (30) gegenübersteht, und die Verbindungskanäle (312; 342) eine offene Fläche aufweisen, die zur Versorgungsscheibe (30) weist, wobei die Versorgungsscheibe (30) eine Abdeckung bildet, welche die offenen Flächen der Verbindungskanäle (312; 342) abdeckt, und wobei Durchgangsöffnungen (313; 343) vorgesehen sind, die sich von den Verbindungskanälen (312; 342) durch die Verbindungsscheibe (31; 34) zum umlaufenden Aktivierungskanal (314) erstrecken, um die Fluidverbindung der Verbindungskanäle (312; 342) mit dem umlaufenden Aktivierungskanal (314) herzustellen.

6. Vorrichtung nach Anspruch 3, wobei die Durchflussöffnungen (324) in der Fläche der Übergabescheibe (32) an einem Aktivierungsdurchmesser (326) angeordnet sind, wobei die Verbindungsscheibe (35) eine zentral angeordnete Öffnung (350) aufweist, die in Fluidverbindung mit dem Saugeinlass der Versorgungsscheibe (30) steht, und wobei die zentral angeordnete Öffnung (350) einen Durchmesser (351) aufweist, der grösser ist als der Aktivierungsdurchmesser, so dass die zentral angeordnete Öffnung (350) der Verbindungsscheibe (35) in direkter Fluidverbindung mit den Durchflussöffnungen (324) der Übergabescheibe (32) steht, und die zentral angeordnete Öffnung (350) der Verbindungsscheibe (35) durch die Versorgungsscheibe (30) von einer Seite und durch die Übergabescheibe (32) von der anderen Seite abgedeckt ist.

7. Vorrichtung nach einem der vorstehenden Ansprüche, weiter aufweisend Mittel zum Erzeugen einer zirkulierenden Bewegung der Gegenstände in der Übergabekammer (2) entlang einer Umlaufbahn, wobei sich ein Teil der Umlaufbahn entlang der Umfangsfläche des drehbaren Übergaberads (3) in Drehrichtung des drehbaren Übergaberads (3) erstreckt.

8. Vorrichtung nach Anspruch 7, weiter aufweisend ein Umkehrelement (20), das in der Übergabekammer (2) an einem gekrümmten Seitenwandabschnitt der Übergabekammer (2) angeordnet ist, wobei der gekrümmte Seitenwandabschnitt und das Umkehrelement (20) am Ende desjenigen Teils der Kreisbahn angeordnet sind, der sich entlang der Umfangsfläche des drehbaren Übergaberads (3) auf eine Weise erstreckt, dass das Umkehrelement (20) und der gekrümmte Seitenwandabschnitt die Bewegungsrichtung der Gegenstände in der Übergabekammer (2) umkehren.

9. Vorrichtung nach Anspruch 8, wobei das Umkehrelement (20) eine tropfenähnliche Form hat, die eine Spitze (200), zwei im Wesentlichen gerade Flanken (201) und einen gekrümmten Abschnitt (202), der die im Wesentlichen geraden Flanken (201) verbindet, aufweist, wobei die Spitze (200) dem Innenraum der Übergabekammer (2) derart zugewandt ist, dass sich die der Umfangsfläche des drehbaren Übergaberads (3) zugewandte Flanke (201) des Tropfens im Wesentlichen tangential zu der Umfangsfläche des drehbaren Übergaberads (3) erstreckt.

10. Vorrichtung nach Anspruch 9, wobei die der Umfangsfläche des drehbaren Übergaberads (203) zugewandte gerade Flanke (201) in einem vorbestimmten Abstand (204) von der Umfangsfläche des drehbaren Übergaberads (3) angeordnet ist, wobei der vorbestimmte Abstand (204) derart ausgewählt ist, dass sich eine Schicht aus einem bis sechs Gegenständen zwischen der Flanke (201) und der Umfangsfläche des drehbaren Übergaberads (3) bildet, insbesondere eine Schicht aus zwei bis vier Gegenständen.

11. Vorrichtung nach einem der Ansprüche 7 bis 10, wobei die Mittel zur Erzeugung der zirkulierenden Bewegung der Gegenstände in der Übergabekammer (2) Düsen (203) aufweisen, die am Ende desjenigen Teils der Umlaufbahn angeordnet sind, der sich entlang der Umfangsfläche des drehbaren Übergaberads (3) erstreckt, wobei die Düsen (203) zur Erzeugung von Luftströmen in der Lage sind, welche die Bewegungsrichtung der Gegenstände in der Übergabekammer (2) entweder zusammen mit dem gekrümmten Seitenwandabschnitt der Übergabekammer (2) oder zusammen mit dem Umkehrelement (20) oder zusammen mit dem gekrümmten Seitenwandabschnitt der Übergabekammer (2) und dem Umkehrelement (20) umkehren.

12. Verfahren zum Einbringen von Gegenständen in einen kontinuierlichen Materialstrom, das die folgenden Schritte aufweist:

- Bereitstellen eines Vorratsbehälters (1), der mehrere Gegenstände enthält;
- Einbringen der Gegenstände vom Behälter (1) in eine Übergabekammer (2), die zwischen dem Behälter (1) und einem drehbaren Übergaberad (3) angeordnet ist, wobei das drehbare Übergaberad (3) Aussparungen (320) aufweist;
- Anwenden von Saugwirkung auf die Aussparungen (320) des drehbaren Übergaberads (3), dadurch Übergeben der Gegenstände von der Übergabekammer (2) in die Aussparungen (320) des drehbaren Übergaberads (3), und Zurückhalten der Gegenstände in den Aussparungen (320);
- Transportieren der Gegenstände, die in den Aussparungen (320) zurückgehalten werden, zu einer Einführstelle, an der die Gegenstände

in den kontinuierlichen Materialstrom eingebracht werden sollen;
- Einbringen der Gegenstände in den kontinuierlichen Materialstrom an der Einführstelle,

wobei das Anwenden von Saugwirkung auf die Aussparungen (320) des drehbaren Übergaberads (3) durch Anwenden von Saugwirkung durch die Mitte des drehbaren Übergaberads (3) ausgeführt wird, durch einen in der Mitte des drehbaren Übergaberads (3) angeordneten Saugeinlass, und durch fluidische Verbindungen, die eine Fluidverbindung zwischen dem Saugeinlass und den Aussparungen (320) herstellen,
dadurch gekennzeichnet, dass der Schritt des Bereitstellens eines Übergaberads das Bereitstellen von drei angrenzend angeordneten Scheiben (30, 31, 32; 34, 35) umfasst, einer Übergabescheibe (32), welche die Aussparungen (320) zum Aufnehmen der Gegenstände von der Übergabekammer (2) aufweist, einer Verbindungsscheibe (31; 34; 35), die mindestens einen Teil der fluidischen Verbindungen zwischen dem Saugeinlass und den Aussparungen (320) aufweist, und einer Versorgungsscheibe (30) die den in der Mitte der Versorgungsscheibe (30) angeordneten Saugeinlass aufweist, wobei die Verbindungsscheibe (31; 34; 35) zwischen der Versorgungsscheibe (30) und der Übergabescheibe (32) angeordnet ist.

13. Verfahren nach Anspruch 12, weiter aufweisend den Schritt des Erzeugens einer zirkulierenden Bewegung der Gegenstände in der Übergabekammer (2) entlang einer Umlaufbahn, wobei sich ein Teil der Umlaufbahn entlang der Umfangsfläche des drehbaren Übergaberads (3) in Drehrichtung des drehbaren Übergaberads (3) erstreckt.

Revendications

1. Appareil pour l'introduction d'objets dans un écoulement continu de matière, comprenant:

- un réservoir (1) pour fournir une pluralité d'objets;
- une roue de transfert rotative (3) destinée à transporter les objets à d'une unité d'insertion pour l'introduction des objets dans l'écoulement 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),

où la roue de transfert rotative (3) est pourvue d'évidements (320) dans lesquels les objets peuvent être transférés et dans lesquels les objets peuvent être conservés par l'application d'aspiration jusqu'à ce que les objets sont fournis de la roue de transfert rotative (3) vers l'unité d'insertion pour l'introduction des objets dans l'écoulement continu de matière,
où la roue de transfert rotative (3) comprend une entrée d'aspiration disposée au centre de la roue de transfert rotative (3) de sorte à fournir une aspiration à travers du centre de la roue rotative (3) et comprenant des raccordements fluidiques pour la fourniture d'une communication fluidique entre l'entrée d'aspiration et les évidements (320),
caractérisé en ce que la roue de transfert rotative (3) comprend trois disques disposés de manière adjacente (30, 31, 32; 34, 35), un disque de transfert (32) comprenant les évidements (320) pour la réception des objets à partir de la chambre de transfert (2), un disque de raccordement (31; 34; 35) comprenant au moins une partie des raccordements fluidiques entre l'entrée d'aspiration et les évidements (320), et un disque d'amenée (30) comprenant l'entrée d'aspiration disposée au centre du disque d'amenée (30), le disque de raccordement (31; 34; 35) étant disposé entre le disque d'amenée (30) et le disque de transfert (32).

2. Appareil selon la revendication 1, dans lequel l'entrée d'aspiration comprend une embase (300) adapté pour recevoir un cylindre de raccordement (40) d'une conduite d'amenée (4), le cylindre de raccordement (40) étant pourvu d'un palier (400), le palier (400) permettant à la roue rotative (3; 30, 31, 32; 34, 35) de tourner autour du cylindre de raccordement (40).

3. Appareil selon la revendication 1 ou la revendication 2, dans lequel les raccordements fluidiques comprennent en outre des canaux de disque de transfert (321) s'étendant à l'intérieur du disque de transfert (32), chacun des canaux de disque de transfert (321) comprenant une partie de canal radiale (322) s'étendant radialement vers l'intérieur à partir du fond de l'évidement respectif (320) vers une extrémité radiale la plus intérieure respective et une partie de canal transversale (323) respective s'étendant à partir de l'extrémité radiale la plus intérieure respective de la partie de canal radiale (322) vers un orifice (324) respectif fourni dans cette surface (325) du disque de transfert (32) faisant face vers le disque de raccordement (31; 34; 35), l'orifice (324) respectif et la partie de canal transversale (323) respective ayant une coupe transversale qui est plus large que la coupe transversale de la partie de canal radiale (322).

4. Appareil selon la revendication 3, dans lequel les orifices (324) dans la surface (325) du disque de transfert (32) sont disposés sur un diamètre d'activation (326), et dans lequel le disque de raccorde-

ment (31; 34) comprend une ouverture disposée de manière centrale (310; 340) qui est en communication fluidique avec l'entrée d'aspiration du disque d'amenée (30), l'ouverture disposée de manière centrale (310; 340) du disque de raccordement (31; 34) ayant un diamètre (311; 341) qui est inférieur au diamètre d'activation (326), et dans lequel le disque de raccordement (31; 34) comprend en outre une pluralité de canaux de raccordement (312; 342) s'étendant radialement vers l'extérieur à partir de l'ouverture disposée de manière centrale (310; 340) vers le diamètre d'activation et étant en communication fluidique avec un canal d'activation circonférentiel (314), le canal d'activation (314) étant fourni sur le diamètre d'activation sur cette surface du disque de raccordement faisant face au disque de transfert (32), le canal d'activation (314) ayant une surface ouverte faisant face vers le disque de transfert (32), le disque de transfert (32) formant un couvercle fermant la surface ouverte du canal d'activation (314) excepté aux emplacements des orifices (324) où le canal d'activation (314) est en communication fluidique avec les orifices (324).

5. Appareil selon la revendication 4, dans lequel le disque de raccordement (31; 34) comprend un nombre de canaux de raccordement (312; 342) qui est inférieur au nombre d'orifices (324) dans le disque de transfert (32), où les canaux de raccordement (312; 342) sont fournis dans cette surface du disque de raccordement (31; 34) faisant face vers le disque d'amenée (30), les canaux de raccordement (312; 342) ayant une surface ouverte faisant face vers le disque d'amenée (30), avec le disque d'amenée (30) formant un couvercle fermant les surfaces ouvertes des canaux de raccordement (312; 342), et où des ouverture de passage (313; 343) sont fournies qui s'étendent à partir des canaux de raccordement (312; 342) à travers du disque de raccordement (31; 34) vers le canal d'activation circonférentiel (314) pour établir la communication fluidique des canaux de raccordement (312; 342) avec la canal d'activation circonférentiel (314).

6. Appareil selon la revendication 3, dans lequel les orifices (324) dans la surface du disque de transfert (32) sont disposés sur un diamètre d'activation (326), où le disque de raccordement (35) comprend une ouverture disposée de manière centrale (350) qui est en communication fluidique avec l'entrée d'aspiration du disque d'amenée (30), et où l'ouverture disposée de manière centrale (350) a un diamètre (351) qui est plus large que le diamètre d'activation, de sorte que l'ouverture disposée de manière centrale (350) du disque de raccordement (35) soit en communication fluidique directe avec les orifices (324) du disque de transfert (32), l'ouverture disposée de manière centrale (350) du disque de raccordement (35) étant couverte par le disque d'amenée (30) à partir d'un côté et par le disque de transfert (32) à partir de l'autre côté.

7. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre un moyen destiné à générer un mouvement de circulation des objets dans la chambre de transfert (2) le long d'un chemin de circulation, une partie du chemin 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).

8. Appareil selon la revendication 7, comprenant en outre un élément de rappel (20) qui est disposé dans la chambre de transfert (2) au niveau d'une partie de paroi latérale courbée de la chambre de transfert (2), la partie de paroi latérale courbée et l'élément de retour (20) étant disposés à l'extrémité de la partie du chemin de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3) d'une manière telle que l'élément de rappel (20) et la partie de paroi latérale courbée inversent le sens du mouvement des objets dans la chambre de transfert (2).

9. Appareil selon la revendication 8, dans lequel l'élément de rappel (20) présente une forme de goutte comprenant une pointe (200), deux flancs essentiellement rectilignes (201) et une partie courbée (202) raccordant les flancs essentiellement rectilignes (201), la pointe (200) étant tournée vers l'intérieur de la chambre de transfert (2) de telle sorte que le flanc (201) de la goutte 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).

10. Appareil selon la revendication 9, 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), en particulier une couche de deux à quatre objets.

11. Appareil selon l'une quelconque des revendications 7 à 10, dans lequel le moyen destiné à générer le mouvement de circulation des objets dans la chambre de transfert (2) comprend des buses (203) disposées à l'extrémité de cette partie du chemin de circulation qui s'étend le long de la surface périphérique de la roue de transfert rotative (3), lesdites buses (203) étant aptes à générer des flux d'air qui, conjointement avec soit la partie de paroi latérale

courbée de la chambre de transfert (2) ou l'élément de retour(20), ou ensemble avec la partie de paroi latérale courbée de la chambre de transfert (2) et l'élément de retour (20), inversent le sens de mouvement des objets dans la chambre de transfert (2).

12. Procédé pour l'introduction d'objets dans un écoulement continu de matière, comprenant les étapes de:

- fournir un réservoir (1) contenant une pluralité d'objets;
- introduire des objets issus du réservoir (1) dans une chambre de transfert (2) disposée entre le réservoir (1) et une roue de transfert rotative (3), la roue de transfert rotative (3) ayant des évidements (320);
- appliquer d'aspiration aux évidements (320) de la roue de transfert rotative (3), transférant de ce fait les objets à partir de la chambre de transfert (2) dans les évidements (320) de la roue de transfert rotative (3) et retenant les objets dans les évidements (320);
- transporter des objets retenus dans les évidements (320) à un emplacement d'insertion où les objets doivent être introduits dans l'écoulement continu de matière;
- introduire des objets dans l'écoulement continu de matière au niveau de l'emplacement d'insertion,

où appliquer d'aspiration sur les évidements (320) de la roue de transfert rotative (3) est exécuté par appliquer d'aspiration à travers du centre de la roue de transfert rotative (3) à travers d'une entrée d'aspiration disposée au centre de la roue de transfert rotative (3) et à travers des raccordements fluidiques établissant une communication fluidique entre l'entrée d'aspiration et les évidements (320),

caractérisé en ce que l'étape de fournir une roue de transfert comprend fournir trois disques disposés de manière adjacente (30,31,32; 34,35), un disque de transfert (32) comprenant les évidements (320) pour la réception des objets à partir de la chambre de transfert (2), un disque de raccordement (31; 34; 35) comprenant au moins une partie des raccordements fluidiques entre l'entrée d'aspiration et les évidements (320), et un disque d'amenée (30) comprenant l'entrée d'aspiration disposée au centre du disque d'amenée (30), le disque de raccordement (31; 34; 35) étant disposé entre le disque d'amenée (30) et le disque de transfert (32).

13. Procédé selon la revendication 12, comprenant en outre l'étape de générer un mouvement de circulation des objets dans la chambre de transfert (2) long du chemin de circulation, une partie du chemin 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).

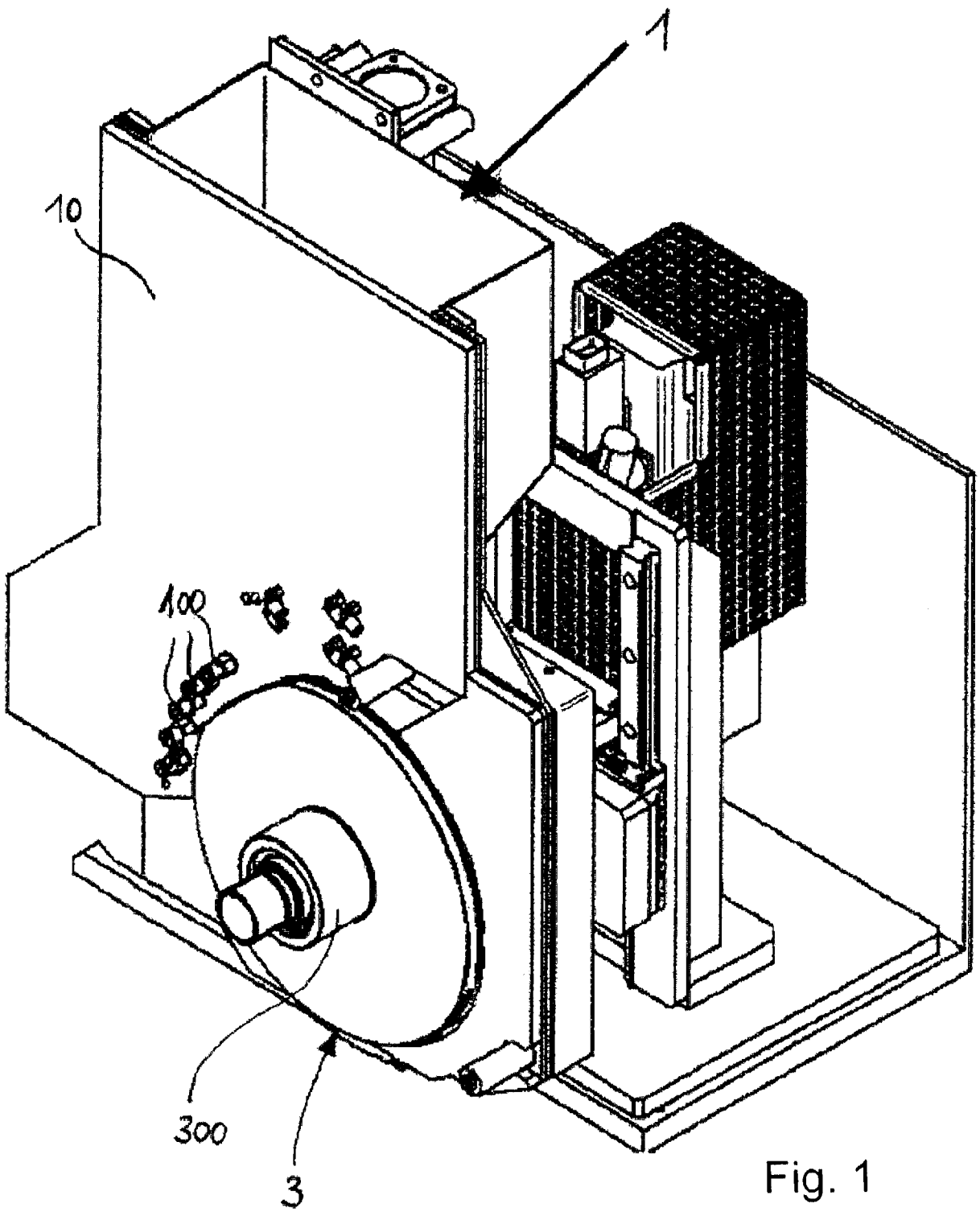


Fig. 1

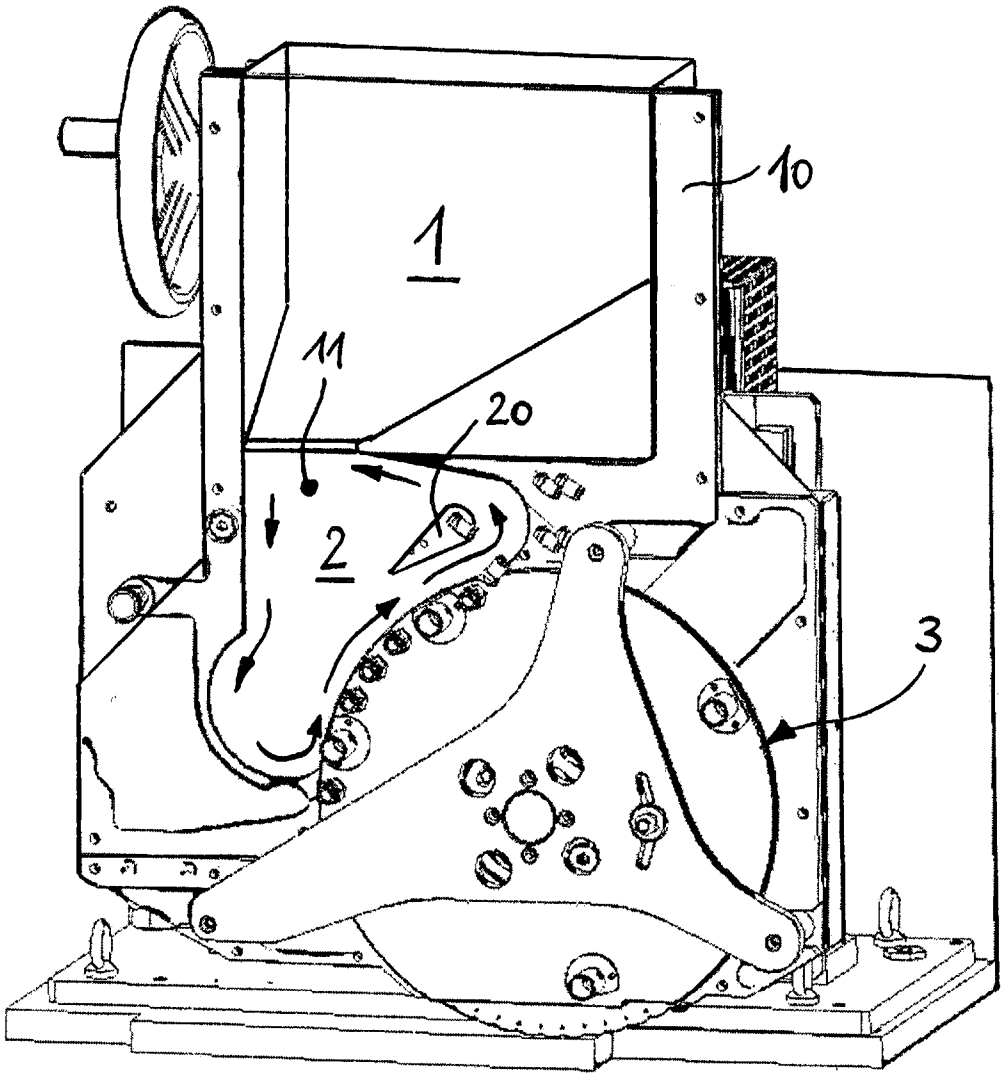


Fig. 2

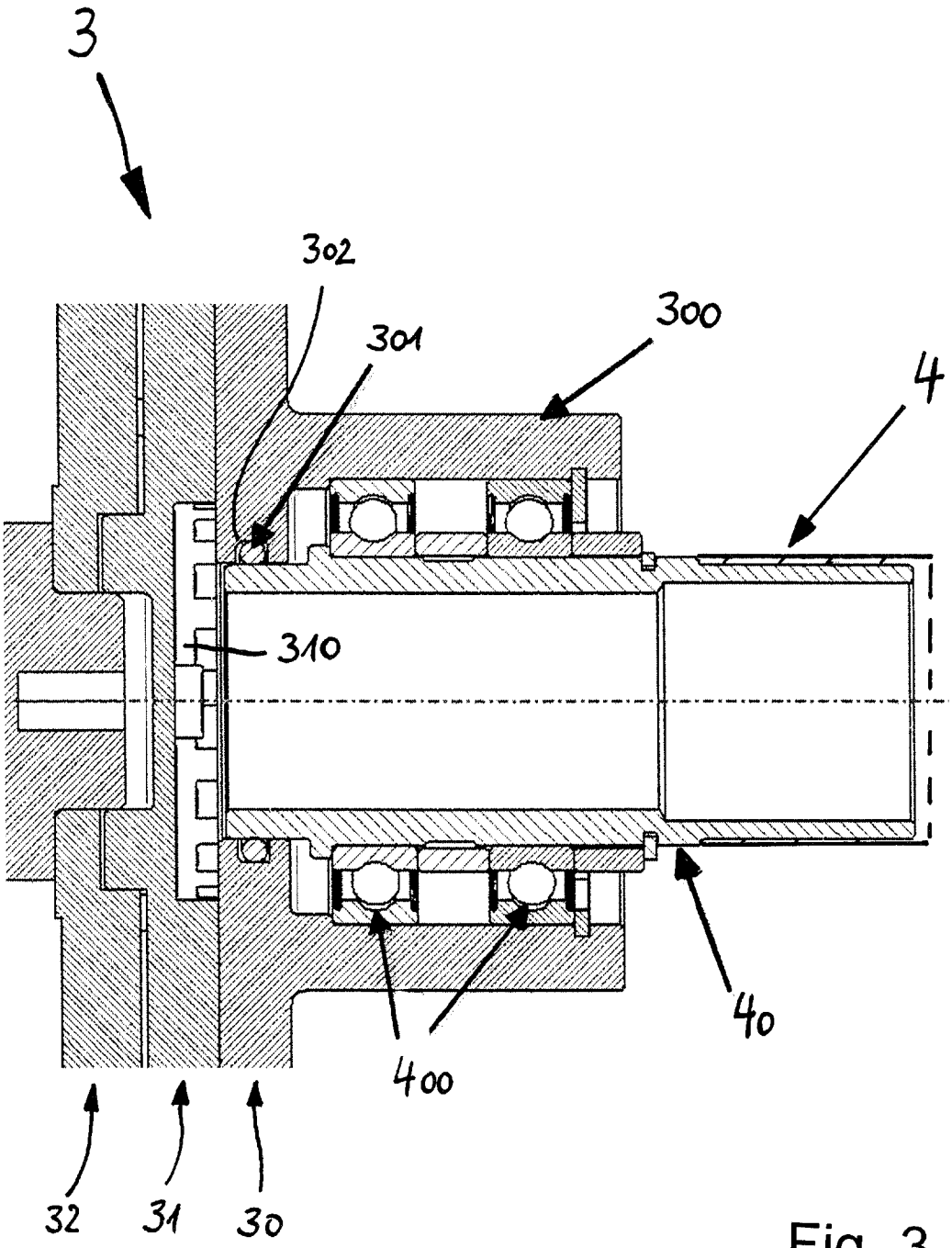


Fig. 3

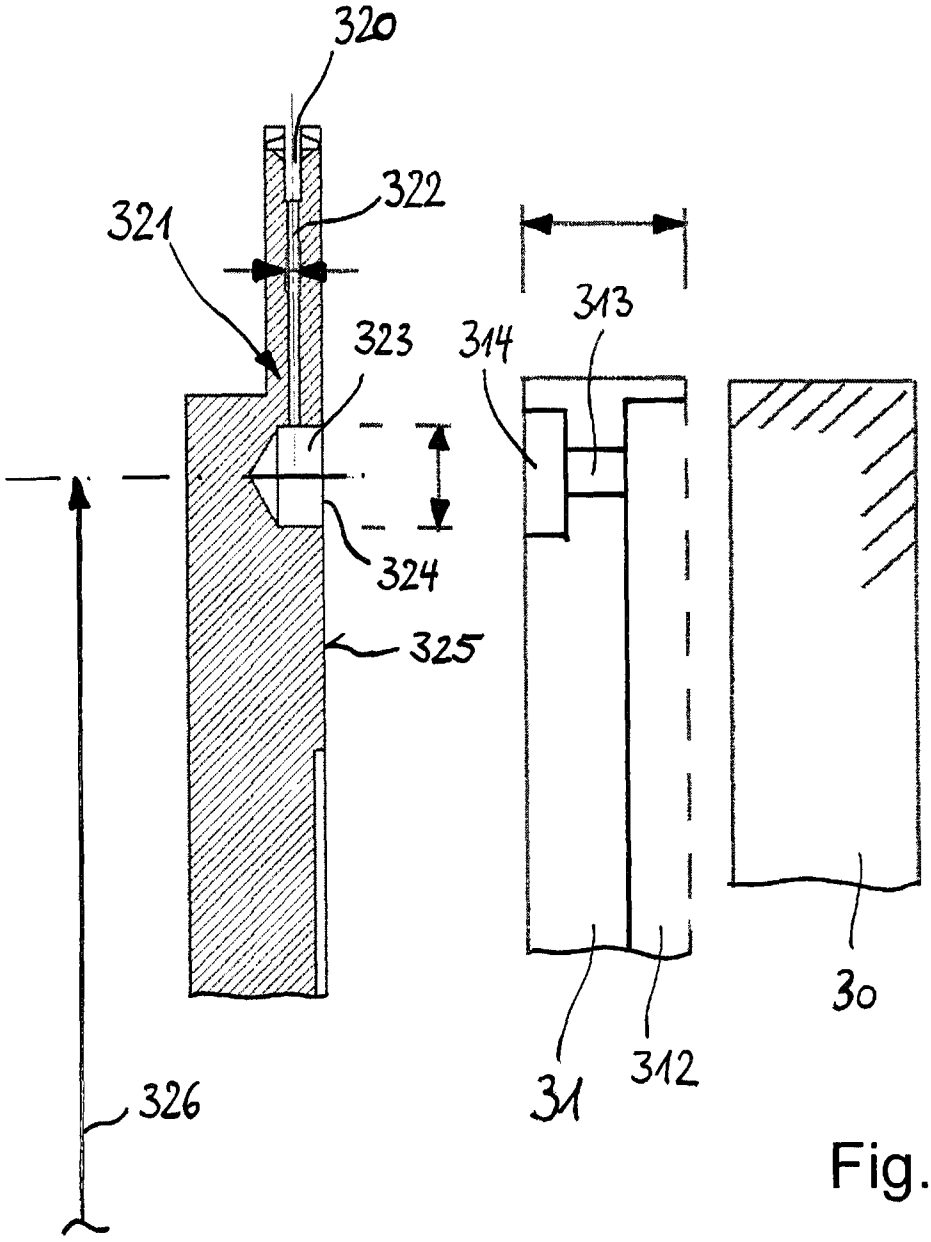


Fig. 4

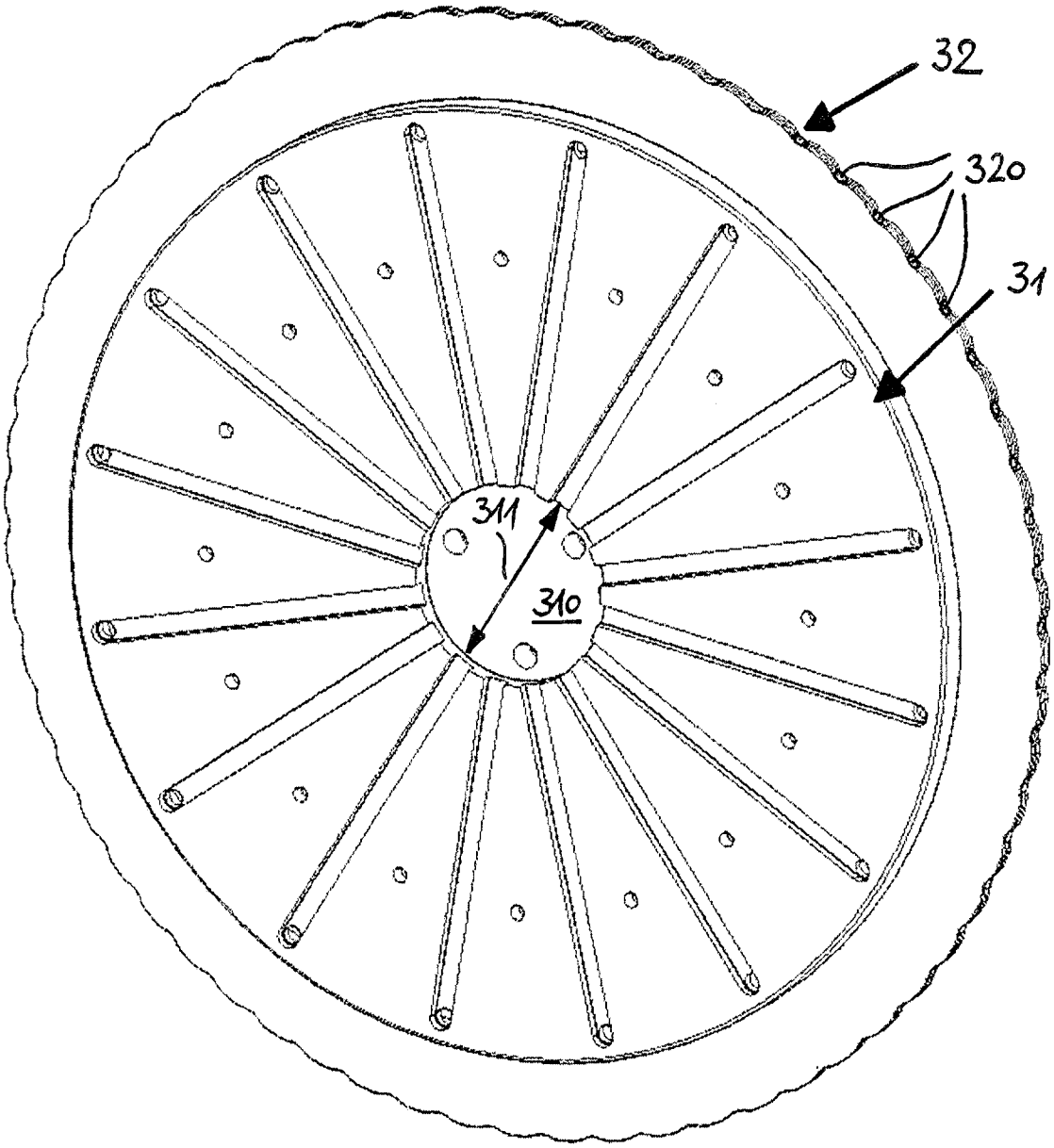
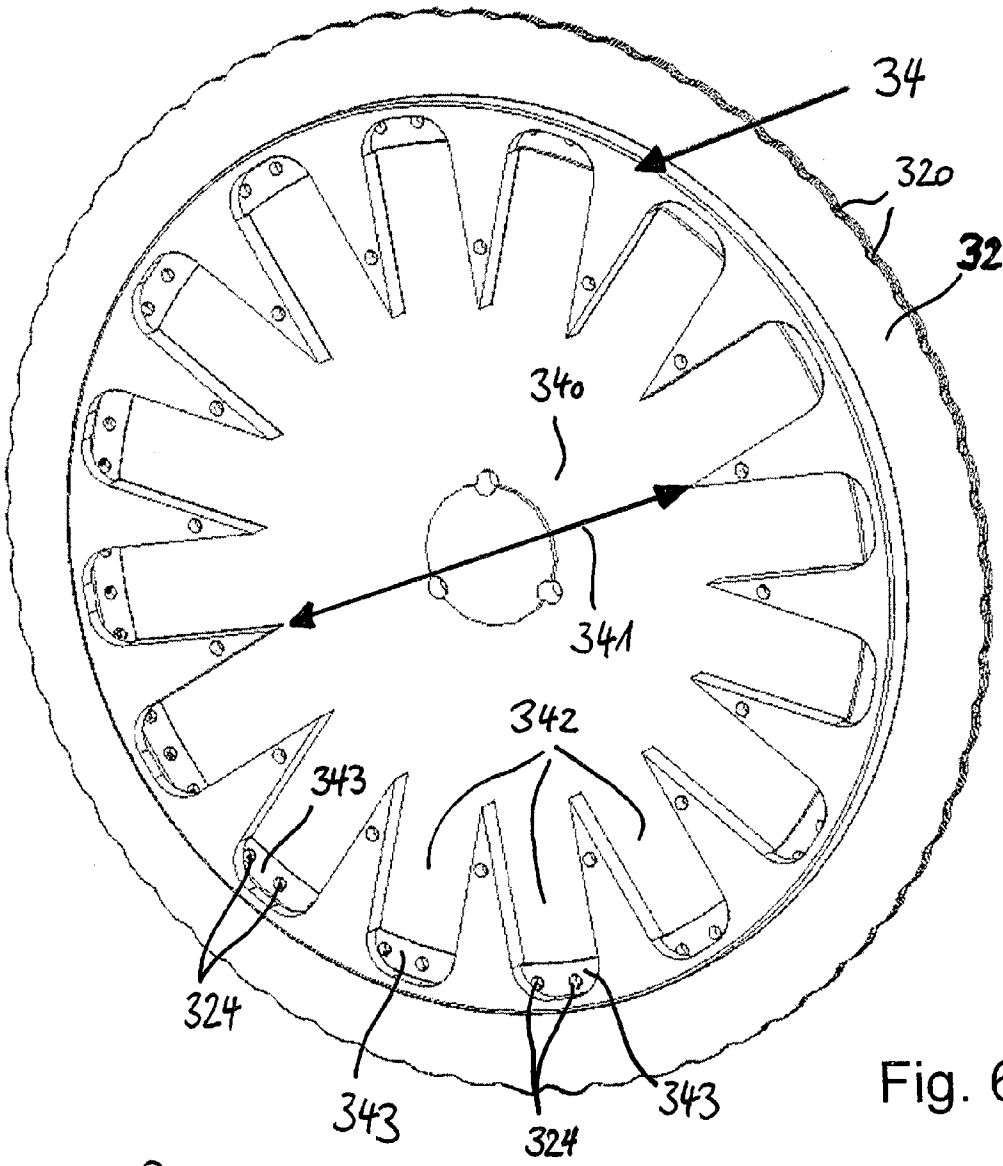


Fig. 5


34
320
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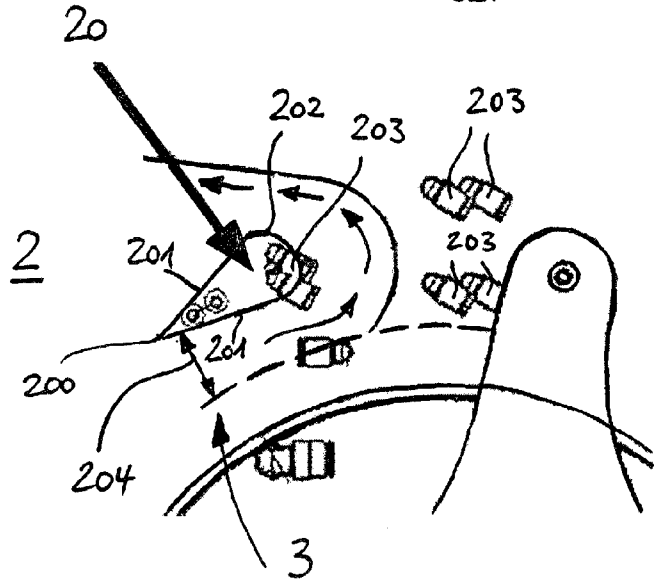
324
343

Fig. 6


20
202
203
203
2
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203
201
200
204
3

Fig. 8

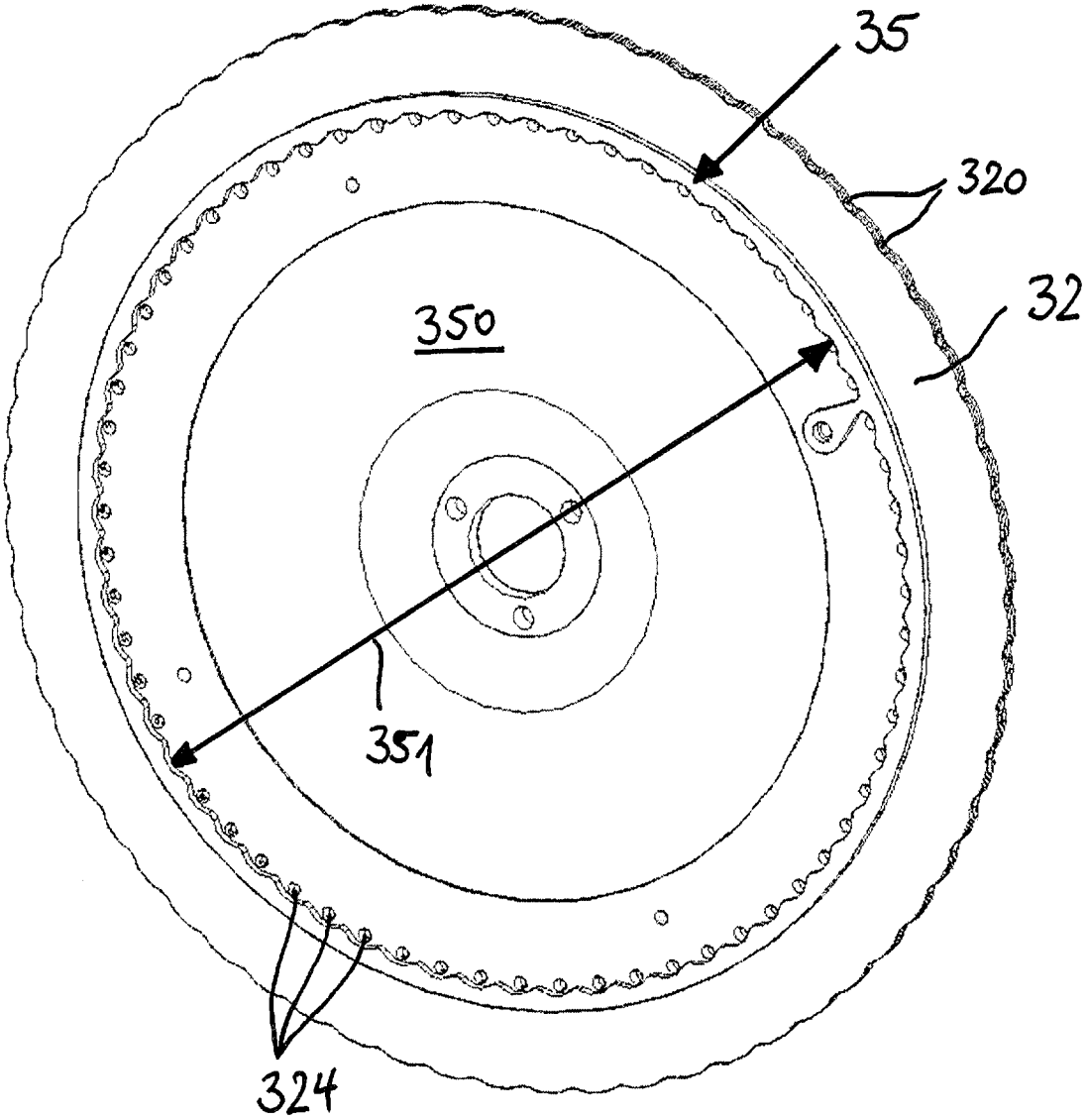

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2010055120 A **[0004] [0030] [0041]**
- WO 201055120 A **[0030]**

SZABADALMI IGÉNYPONTOK

1. Berendezés tárgyak folyamatos anyagáramba történő bevezetésére, amely tartalmaz:
- egy tartályt (1), amely számos tárgy tárolására szolgál;
- forgatható továbbító kereket (3), amely a tárgyak beillesztőegységbe történő továbbítására szolgál, amely a tárgyaknak a folyamatos anyagáramba történő bevezetésére alkalmas;
- továbbító kamrát (2), amely a tárgyaknak a forgatható továbbító kerékre (3) történő továbbítására szolgál, ahol a továbbító kamra (2) a tartály (1) és a forgatható továbbító kerék (3) között van elrendezve,

ahol a forgatható továbbító kerék (3) hornyokkal (320) van ellátva, amelyekbe a tárgyak továbbíthatók, és amelyekben a tárgyak szívás alkalmazása révén megtarthatók mindaddig, amíg a tárgyakat a forgatható továbbító kerékből (3) a tárgyaknak a folyamatos anyagáramba történő juttatására alkalmas illesztőegységbe adagoljuk,

és ahol a forgatható továbbító kerék (3) tartalmaz egy szívóbemenetet, amely a forgatható továbbító kerék (3) közepén van elrendezve úgy, hogy szívóhatást hoz létre a forgatható kerék (3) közepén át, és áramlási összekötő elemeket tartalmaz annak érdekében, hogy áramlási összeköttetést hozzunk létre a szívóbemenet és a hornyok (320) között,

azzal jellemezve, hogy a forgatható továbbító kerék (3) három egymás mellett elrendezett koronggal (30, 31, 32; 34, 35) van ellátva, ahol továbbító korongon (32) a továbbító kamrából (2) származó tárgyak befogadására szolgáló hornyok (320) vannak kiképezve, csatlakozó korong (31; 34; 35) tartalmazza a szívóbemenet és a hornyok (320) közötti áramlási összeköttetés legalább egy részét, és tápkorong (30) tartalmazza a tápkorong (30) középpontjában elrendezett szívóbemenetet, és a csatlakoztató korong (31; 34; 35) a tápkorong (30), és a továbbító korong (32) között van elrendezve.

2. Az 1. igénypont szerinti berendezés, ahol a szívóbemenet tartalmaz egy tápvezeték (4) csatlakozóhengerének (40) befogadására szolgáló foglalatot (300), ahol a csatlakozóhenger (40) csapággyal (400) van ellátva, és a csapágy (400) lehetővé teszi a forgatható továbbító kerék (3; 30, 31, 32; 34, 35) számára, hogy elforduljon a csatlakozóhenger (40) körül.

3. Az 1. vagy 2. igénypontok szerinti berendezés, ahol az áramlási összeköttetések továbbító korong csatornák (321), amelyek a továbbító korongon (32) belül helyezkednek el és a továbbító korong egyes csatornái (321) egyrészt sugárirányú csatornaszakasszal (322) vannak kialakítva, amelyek sugárirányban befelé húzódnak a megfelelő horony (320) aljából a sugárirányban legbelső vég felé, másrészt megfelelő keresztirányú csatornaszakasszal (323) vannak kialakítva, amelyek a megfelelő sugárirányú csatornaszakaszok (322) legbelső végétől húzódnak egy nyílás (324) felé, amely a továbbító korong (32) azon felületén (325) van elrendezve, amely a csatlakozó korong (31; 34; 35) irányába néz, és a megfelelő nyílás (324), valamint a keresztirányú csatornaszakasz (323) keresztmetszete nagyobb, mint a sugárirányú csatornaszakasz (322) keresztmetszete.

4. A 3. igénypont szerinti berendezés, ahol a továbbító korong (32) felületén (325) az aktiválási átmérőn (326) elrendezett nyílások (324) vannak elrendezve, és ahol a csatlakoztató korong (31; 34) tartalmaz egy központi elrendezésű nyílást (310; 340), mely áramlási összeköttetésben van a tápkorong (30) szívóbemenetével, a csatlakoztató korong (31; 34,) központi elrendezésű nyílásának (310; 340) átmérője (311; 341) kisebb, mint az aktiválási átmérő (326), és ahol a csatlakoztató korong

(31; 34) továbbá számos csatlakoztató csatornát (312, 342) tartalmaz, amelyek sugárirányban kifelé húzódnak a központi elrendezésű nyílástól (310; 340) az aktiválási átmérőig, és áramlási összeköttetésben vannak a kerületmenti aktiválási csatornával (314), az aktiválási csatorna (314) az aktiválási átmérőnél a csatlakoztató korongnak azon a felületén van elrendezve, amely a továbbító korong (32) felé néz, és az aktiválási csatorna (314) nyitott felülettel van ellátva, amely a továbbító korong (32) irányába néz, és a továbbító korong (32) olyan fedelet képez, amely lezárja az aktiválási csatorna (314) nyitott felületét, kivéve a nyílások (324) helyeit, ahol az aktiválási csatorna (314) áramlási összeköttetésben van a nyílásokkal (324).

5. A 4. igénypont szerinti berendezés, ahol a csatlakoztató korong (31; 34) számos csatlakoztató csatornával (312; 342) van ellátva, amelyek száma kisebb, mint a továbbító korong (32) nyílásainak (324) száma, ahol a csatlakoztató csatornák (312; 342) a csatlakoztató korongnak (31; 34) azon a felületén vannak kialakítva, amely a tápkorong (30) irányába néz, a csatlakoztató csatornáknak (312; 342) olyan nyitott felülete van, amely a tápkorong (30) irányába néz úgy, hogy a tápkorong (30) fedelet képez, amely lezárja a csatlakoztató csatornák (312; 342) nyitott felületeit, és ahol átmenőnyílások (313; 343) vannak kialakítva, amelyek a csatlakozó csatornákból (312; 342) húzódnak át a csatlakozó korongon (31; 34) a kerületmenti aktiválási csatornáig (314), annak érdekében, hogy létrehozzák az áramlási összeköttetést a csatlakozó csatornák (312; 342) és a kerületmenti aktiváló csatorna (314) között.

6. A 3. igénypont szerinti berendezés, ahol a továbbító korong (32) felületén elrendezett nyílások (324) az aktiválási átmérőnél (326) annak elrendezve, ahol a csatlakozó korong (35) központi elhelyezkedésű nyílással (350) van ellátva, amely áramlási összeköttetésben van a tápkorong (30) szívóbemenetével, és ahol a központosan elrendezett nyílás (350) átmérője (351) nagyobb, mint az aktiválási átmérő úgy, hogy a csatlakozó korong (35) központi elhelyezkedésű nyílása (350) közvetlen áramlási összeköttetésben van a továbbító korong (32) nyílásaival (324), a csatlakozó korong (35) központi elhelyezkedésű nyílása (350) egyik oldalról a tápkoronggal (30), másik oldalról a továbbító koronggal (32) le van fedve.

7. Az előző igénypontok bármelyike szerinti berendezés, amely továbbá tartalmaz olyan eszközt, amely a továbbító kamrában (2) a tárgyak keringő mozgását hozza létre kenngető pálya mentén, és a keringető pálya egy része a forgatható továbbító kerék (3) kerületmenti felülete mentén húzódik a forgatható továbbító kerék (3) forgásirányában.

8. A 7. igénypont szerinti berendezés, amely továbbá tartalmaz egy visszatérítő tagot (20), amely az átadókamrában (2) van elrendezve az átadókamra (2) egyik ívelt falszakaszánál, és az ívelt falszakasz valamint a visszatérítő elem (20) a forgatható továbbító kerék (3) kerületmenti felülete mentén húzódó keringető pályának a végénél van elrendezve oly módon, hogy a visszatérítő elem (20) és az ívelt oldalú falszakasz megfordítja a tárgyak mozgásirányát az átadókamrában (2).

9. A 8. igénypont szerinti berendezés, ahol a visszatérítő tag (20) csepp alakú, és van egy csúcsrésze (200), továbbá két lényegében egyenes szárnya (201) és egy ívelt része (202), amely összeköti a lényegében egyenes szárnyakat (201), úgy, hogy a csúcs (200) az átadókamra (2) belsejének irányába néz oly módon, hogy a csepp szárnya (201), amely a forgatható továbbító kerék (3) kerületmenti felületének irányába néz, lényegében érintőlegesen húzódik a forgatható továbbító kerék (3) kerületmenti felületére.

10. A 9. igénypont szerinti berendezés, ahol a forgatható továbbító kerék (203) kerületmenti

felületének irányába néző egyenes szárny (201) a forgatható továbbító kerék (3) kerületmenti felületétől előre meghatározott távolságban (204) van elrendezve, és az előre meghatározott távolság (204) úgy van megválasztva, hogy a szárny (201) és a forgatható továbbító kerék (3) kerületmenti felülete között egy–hat tárgyból álló réteg, különösen kettő–négy tárgyból álló réteg képződik.

11. A 7–10. igénypontok bármelyike szerinti berendezés, ahol a átadókamrában (2) lévő tárgyak keringető mozgását előidéző eszköz fúvókákból (203) áll, amelyek a keringetési pályának azon végénél vannak elrendezve, amely a forgatható továbbító kerék (3) kerületmenti felülete mentén húzódik, és az említett fúvókák (203) alkalmasak arra, hogy légáramlást hozzanak létre, amely az átadókamra (2) ívelt oldalfal szakaszával vagy a visszatérítő elemmel (20), vagy mindkettő részvételével, vagyis az átadókamra (2) ívelt falszakaszával és a visszatérítő elemmel (20) együtt, megfordítja a tárgyak áramlásának irányát az átadókamrában (2).

12. Eljárás tárgyak folyamatos anyagáramba történő bevezetésére, amelynek során:

- számos tárgyat tartalmazó tartályt (1) biztosítunk;
- a tárgyakat a tartályból (1) bevezetjük egy átadókamrába (2), amely a tartály (1) és egy forgatható továbbító kerék (3) között van elrendezve, és a forgatható továbbító kerék (3) hornyokkal (320) van ellátva;
- szívóhatást gyakorolunk a forgatható továbbító kerék (3) hornyaira (320), és ezzel átadjuk a tárgyakat az átadó kamrából (2) a forgatható továbbító kerék (3) hornyaira (320), és a tárgyakat megtartjuk a hornyokban (320);
- a hornyokban (320) megtartott tárgyakat beillesztési helyre továbbítjuk, ahol a tárgyakat bevezetjük a folyamatos anyagáramba;
- a tárgyakat a folyamatos anyagáramba a bevezetés helyén vezetjük be,

ahol a forgatható továbbító kerék (3) hornyaira (320) gyakorolt szívóhatást olyan szívással alakítjuk ki, amely szívás a forgatható továbbító kerék (3) középpontján át a forgatható továbbító kerék (3) középpontjában elrendezett szívóbemeneten (3) át és olyan áramlási összeköttetésen keresztül valósul meg, amelyet a szívóbemenet és a hornyok (320) közötti áramlási összeköttetésben hozunk létre,

azzal jellemezve, hogy az továbbító kerék alkalmazása során három szomszédosan egymás mellett elrendezett korongot (30, 31, 32; 34, 35) alkalmazunk, ahol az átadókorong (32) az átadókamrából (2) áramló trágyak befoagdására szolgáló hornyokat (320) tartalmaz, a csatlakoztató korong (31, 34; 35), a szívóbemenet és a hornyok (320) közötti áramlási összeköttetés legalább egy részét tartalmazza, valamint a tápkorong (30) a tápkorong (30) közepén elrendezett szívóbemenetet tartalmazza, és a csatlakoztató korong (31; 34; 35) a tápkorong (30) és az átadókorong (32) között van elrendezve.

13. A 12. igénypont szerinti eljárás, amelynek során továbbá az átadókamrában (2) a tárgyakat egy keringető pálya mentén keringő mozgásra kényszerítjük, és a keringető útvonal egy része a forgatható továbbító kerék (3) kerületmenti felülete mentén, a forgatható továbbító kerék (3) forgásának irányában húzódik.

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