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(54) **CONVEYANCE APPARATUS AND METHOD FOR CONVEYING OBJECTS**

FÖRDERVORRICHTUNG UND VERFAHREN ZUM FÖRDERN VON GEGENSTÄNDEN

APPAREIL DE TRANSPORT ET PROCÉDÉ POUR TRANSPORTER DES OBJETS

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Description

[0001] The present invention relates to a conveyance apparatus for objects, in particular substantially cylindrical objects such as, for example filter elements or filter segments, for the use in smoking articles, and a method for conveying these objects.

[0002] In the prior art conveyance apparatus for filter segments are known which comprise a first conveyance means in the form of a drum provided with axial flutes at the outer circumference of the drum. A plurality of substantially cylindrical filter elements is provided in some of the flutes and rotates together with the drum along a first circumferential motion path with respect to the drum. As a second conveyance means, a driving chain is provided, which extends in the axial direction of the drum and engages at least one of the plurality of objects comprised in one flute of the drum. Thus, the chain is adapted to convey the objects along a second motion path which is substantially axial in the direction of the drum, along the flutes to remove the objects from the drum. Further, this type of conveyance apparatus for filter elements comprises a stationary guiding means, which is enabled to guide the objects removed from the flutes of the drum while maintaining the orientation of their longitudinal axis which is in the conveyance direction of the guiding means. To enable that the drum can be continuously rotated while the plurality of objects is removed from one flute of the drum, the guiding means comprises an increased width at its end which is facing the drum.

[0003] However, the conveyance apparatus as known in the art has the problem that, due to the increased width of the guiding means, the objects which have just been removed from the flutes of the drum are not stably held in their preferred orientation and may, thus, rotate and be damaged or jam the section of increased width of the guiding means.

[0004] WO-A-2009/074540 discloses a rotating guiding element that moves with the same radial speed as the fluted drum. The rotating guiding element comprises tapering grooves that guide the individual filter elements from the fluted drum into a stationary channel.

[0005] Document WO-A-2011/008802 discloses an apparatus and method for assembly of multi-segment rod-like articles of the prior art.

[0006] It is the object of the invention to provide a conveyance apparatus for objects and a method for conveying objects, wherein the transition of objects, in particular filter elements for smoking articles, in between a first conveyance means and a second conveyance means with different motion paths is secured, in particular for short filter elements.

[0007] According to the invention a conveyance apparatus is provided that comprises a first conveyance means with a plurality of holding means for objects. According to the invention, the conveyance means is conveying the objects along a first motion path. The apparatus further comprises a second conveyance means for

removing the objects from the first conveyance means along a second motion path that is different from the first motion path. According to the invention, the conveyance means is adapted to receive the objects along the second motion path while being adapted to follow the movement of the first conveyance means along the first motion path at least while receiving the objects transferred along the second motion path. According to the invention advantageously there is no need for a significantly widened section or flared entry portion as shown in the prior art. The synchronization of the collecting means with the movement of the first conveyance means allows for an alignment of the conveyance means even in motion. Thus, at least the end of the collection means, which is facing the first conveyance means, is at a suitable position for receiving the objects which are moving along the second motion path. The objects are in particular filter elements or filter segments for smoking articles.

[0008] The term "filter segment" is used throughout the specification to refer to a segment of a filter that may form a part of or be the entire filter for a smoking article. The filter segment may also comprise the filter elements of more than one filter, that is, a rod of multiple filter elements that is severed into smaller filter segments at a later production of smoking articles. Typically, such a filter rod has the length of two or four filters of the final smoking article. Examples for filter segments are, without limitation, plain filter tow plugs or filter tow plugs with additional elements like, for example, beads, capsules, plant material or threads disposed in the filter material. Further examples for filter segments are non-cuttable objects like, for example, restrictor elements or tubular elements. Further examples for filter segments are plugs comprising other non-tow material, like for example, plant material, beads, capsules or granules or combinations thereof. The segments may also be combinations of two to five individual filter elements, like for example a double filter segment comprising a plain filter tow segment and a filter tow segment with carbon beads. The segments may also be combination of filter segments as above with "void" elements, that is, segments that are empty, like for example a so called plug-space-plug filter or a filter with a mouth-end cavity. For the avoidance of doubt, the term "filter" is used to refer to the location of the filter segment in the filter portion of the smoking article without making a reference of the possible filtration effect of such a filter segment.

[0009] The collecting means is adapted to move in the direction substantially opposite to the first motion path of the first conveyance means after having received the objects from at least one holding means of the first conveyance means. Thus, objects can be received from the next downstream holding means on the first conveyance means. This reciprocating motion of the collecting means enables that objects from subsequent holding means on the first conveyance means can be received in the collecting means while the first conveyance means is constantly moving.

[0010] Preferably, the movement velocity of the collecting means in the direction substantially opposite to the first motion path is higher than the movement velocity of the collecting means during following the movement of the first conveyance means along the first motion path. In particular, it is at least two times higher, preferably at least five times higher. This has the benefit that the time in which the objects can be transferred from the first conveyance means to the collecting means is increased, while the time the collecting means is moved in the opposite direction of the first motion path is lowered, such that the throughput of objects in the conveyance apparatus can be increased.

[0011] Preferably, the first conveyance means is a drum rotating around its central axis, and the first motion path is the circumferential direction on the circumference of the drum. Thus, the first motion path is defined as a circle whose diameter substantially corresponds to the diameter of the drum. The direction of movement on the first motion path is defined by the rotation direction of the drum. Drums are common conveyance means for components of smoking articles. Preferably, the objects are provided in a substantially radial direction to the drum, for example from a hopper. The objects are then rotated together with the drum until they are removed by the second conveyance means.

[0012] In one embodiment, the preferred holding means are flutes in the outer circumference of the drum, which extend along the second motion path, which is preferably substantially in the axial direction of the drum. Preferably, the flutes are linear recesses in the axial direction at the outer circumferential surface of the drum. Preferably, the recesses forming the flutes have a semi-circular cross section to facilitate the accommodation of cylindrical objects. Preferably, the objects are held in the flutes by the application of a vacuum.

[0013] Preferably, suction holes provided with a lower pressure than ambient pressure are arranged in the flutes to enable to hold the objects in the flutes. The suction holes are preferably connected by means of suction lines in the drum to a vacuum source, which is provided separate from the drum.

[0014] In one embodiment, the collecting means is a channel bordering on the first conveyance means, having a slightly funnel-shaped receiving end portion. The slightly funnel-shaped receiving end portion is arranged next to the first conveyance means and is adapted to receive objects moving along the second motion path while following the movement of the first conveyance means along the first motion path. The funnel-shaped receiving portion is only slightly widened, as it only has to enable a smooth transition of the objects from the first conveyance means to the collecting means and not to correct any misalignment in between the collecting means and the first conveyance means as known in the prior art. Preferably, the width of the funnel-shaped receiving end portion is smaller than the length of the objects. This prevents that the objects can turn other than around their

longitudinal axis. Preferably, the alignment in between the collecting means and the first conveyance means is obtained by the synchronous movement of at least a portion of the collecting means with the first conveyance means along the first motion path. Preferably, the funnel-shaped receiving end portion of the collecting means is arranged directly at the end portion of one of the flutes and moves together with the flutes which are arranged on the rotating drum. Usually the end portion of the flute is at the outer circumference of an axial end portion of the drum.

[0015] Preferably, the channel has a cross-section adapted to the geometry of the objects for substantially maintaining the orientation of a longitudinal axis of the objects in the channel direction. In particular, the objects have a length along the longitudinal axis which is greater than the width or the height of the objects. In particular, the objects are cylindrical objects, wherein the longitudinal axis extends centrally and in parallel to the nappe of the cylindrical objects. Thus, the channel preferably has a circular or semi-circular cross-section which is slightly larger than the diameter of the cylindrical objects but substantially smaller than the length of the objects in the longitudinal direction. Thus, the orientation of the longitudinal axis is substantially maintained throughout the channel, while the cylindrical objects are not restricted from rotating around their longitudinal axis. In particular, the longitudinal axis of the objects is in alignment with the second motion path.

[0016] In one embodiment, the collecting means is mounted by means of a hinge at a distance to the receiving end portion, so that the receiving end portion is enabled to follow the movement of the first conveyance means along the first motion path by means of rotating around the hinge. Preferably, the rotational axis of the hinge is substantially perpendicular to the rotational axis of the drum. This is a further reason to have a slightly larger funnel in order to compensate for the change of angle between the flute and the channel of the collecting means. The rotation velocity of the collecting means is determined by the rotation velocity of the drum multiplied by the radius of the drum and divided by the distance in between the hinge and the drum. Thus, the collecting means, which is substantially directed towards the drum, moves with its receiving end portion at substantially the same speed as the corresponding flute of the drum. However, as the distance in between the drum and the receiving end portion of the collecting means will increase if the collecting means is not directed towards the drum, a reciprocating rotation of the collecting means is carried out during which the collecting means remains substantially directed towards the drum. For example, on a left to right movement of the collecting means, the object would start to enter the funnel of the collecting means towards the right side of the funnel, but would finish the transition between holding means and collecting means towards the left side of the funnel.

[0017] Preferably, each holding means on the first con-

veyance means holds a plurality of aligned objects. The collecting means is adapted to follow the movement of the first conveyance means while the second conveyance means transfers the plurality of aligned objects from one holding means to the collecting means. Preferably, 2 to 10 objects are provided in each holding means in the first conveyance means, more preferably, 2 to 6 objects. As several objects can be transferred at the same time from one holding means to the collecting means, a high throughput of the apparatus can be obtained.

[0018] In one embodiment, the second conveyance means is a belt or a chain with driving protrusions, which are adapted to engage with the objects in the holding means of the first conveyance means and to convey the objects into the collecting means. The driving protrusions move along the holding means and engage the objects. Preferably, the driving protrusions are fingers provided on the belt or chain. Preferably, the holding means are flutes on a fluted drum. Thus, the objects are pushed into the collecting means and are removed from the holding means of the first conveyance means. In particular, the protrusions will only engage the most upstream objects in the holding means while all downstream objects will be pushed by the adjacent upstream objects. Preferably, the protrusions are arranged with a certain flexibility along the first motion path, so that they remain in the holding means despite the holding means being moved further along the first motion path.

[0019] Preferably, the holding means are adapted to guide the objects arranged therein, while the objects are driven by the belt or chain. Thus, the belt or chain has only to provide a driving force, while the alignment and guiding will be provided by the holding means.

[0020] Common driving protrusions known in the art may be provided to engage the objects. Such common driving protrusion may be provided on the belt or chain so that they maintain their orientation with respect to the belt or chain and are, thus, changing their orientation whenever the belt or chain changes its orientation. In particular, the driving protrusions will typically perform a change of orientation in the circumferential direction of a guiding wheel, like for example a sprocket. However, this will lead to a velocity increase of the tip of the protrusion and thus to an increased driving velocity regarding the objects which causes an unsteady conveyance velocity of the objects. Further, the changing of the orientation of the driving protrusion may pinch and damage the object during the change of orientation.

[0021] Preferably, in one embodiment of the invention, the driving protrusions, in particular, fingers are arranged on the belt or chain, such that they maintain their absolute orientation throughout the movement of the belt or chain. That means while the belt or chain section to which the driving protrusion is fixed rotates around the pulleys or sprockets, the driving protrusion remains in the same orientation. In particular, this is enabled by a mechanical transmission in between the belt or chain and the driving protrusions, which compensates the rotation of the belt

or chain. By means of the mechanical transmission in between the protrusions and the belt or chain, the protrusions remain in one orientation. Preferably, the orientation of the driving protrusions remains substantially vertical throughout the entire motion of the driving protrusions. Thus, the protrusions will only slightly reduce their driving velocity when the belt or chain is guided around a pulley or chain sprocket, while being retracted from the objects. This allows for a smooth, continuous movement of the objects. Preferably, two driving protrusions are provided on the belt or chain.

[0022] In one embodiment, at least one air nozzle is provided in the collecting means to supply pressurized air for conveying the objects. The air nozzle forms a beneficial driving means for the objects in the collecting means, as it enables that no additional mechanical parts have to be provided in the collecting means to drive the objects. This is particularly beneficial, as the collecting means has in some embodiments, the form of a channel, and thus does not allow a proper engagement of outside driving means with the objects. Further, the air nozzles allows to design a lightweight collecting means, which is beneficial regarding reciprocating movements at high speed of the collecting means. However, additionally or alternatively the collecting means may comprise a slot for allowing a driving means, such as the aforementioned protrusions, to engage with the objects.

[0023] In one embodiment, the collecting means comprises a downstream end portion which is arranged adjacent to an upstream set of rollers next to which a downstream set of rollers is arranged. Each set of rollers engages the objects from at least two sides, wherein the upstream set of rollers rotates at a velocity lower than the downstream set of rollers, so that objects which were previously adjacent to each other are separated from each other. Thus, a set of objects in contact with each other upstream of the rollers will have a defined distance in between the objects downstream of the rollers.

[0024] The distance in between the upstream set of rollers and the downstream set of rollers is adjustable, enabling objects of different lengths to be processed. As the velocity of the sets of rollers is different, the distance has to be adjusted so that the length of the object is not greater than the distance in between the engaging portions of the two sets of rollers. Such, objects are advantageously not engaged at the same time by both the upstream and downstream set of rollers.

[0025] In one embodiment, a conveyance disk is provided downstream of the sets of rollers, the conveyance disk having teeth which engage each of the objects separated by the sets of rollers individually to arrange them at defined locations of a further downstream conveyance line. Preferably, the distance between the objects created by the rollers is adapted to allow the conveyance disk to enter the teeth between the objects.

[0026] The object of the invention is further solved by a method for conveying objects, in particular, filter elements for smoking articles, which comprises the following

steps.

[0027] First, the objects are conveyed in a plurality of holding means on a first conveyance means along a first motion path. Then, all objects are removed from one of the holding means along a second motion path which is different from the first motion path. Subsequently, the objects are collected by a collecting means which follows the movement of the first conveyance means along the first motion path at least while receiving the objects along the second motion path.

[0028] The collecting means carries out a reciprocating movement substantially along, and substantially opposite to, the first motion path. The movement in the substantially opposite direction of the first motion path constitutes a returning motion. Thus, the collecting means can be maintained in alignment with one of the holding means while the objects are transferred from the holding means to the collecting means, and then be brought into alignment with the next or another of the holding means.

[0029] In a preferred embodiment, the movement velocity of the collecting means during the step of returning is higher than during the step of collecting the objects.

[0030] Preferably, the objects are in contact with the next upstream and downstream objects in the collecting means and a defined distance is established in between each of the objects downstream of the collecting means. The defined distance allows that the objects can be individually selected and conveyed by further processing means during the manufacture of smoking articles.

[0031] The method may further comprise all features specified as inherent functional features of the conveyance apparatus according to the various embodiments of the invention.

[0032] The invention will be further described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a partially sectional side view of a conveyance apparatus according to an embodiment of the invention;

Figure 2 is a partial bottom view of the conveyance apparatus of Figure 1.

[0033] In Figure 1, a conveyance apparatus 1 for objects 2, in particular filter elements for smoking articles, is depicted. Filter elements are substantially cylindrical objects. Typically, such filter elements have a greater length than diameter. Furthermore, filter elements may comprise a constriction in their nappe, which is a section of lower diameter. A longitudinal axis is defined to extend centrally in the objects in parallel to their nappe in the direction of the length of the objects and perpendicular to their diameter. The objects 2 may in particular be restrictors for smoking articles, which are combined with filter material to form a filter segment of a smoking article. These types of restrictors are preferably formed from plastic material.

[0034] The objects 2 are initially provided to a drum 3,

which is depicted in cross section in Figure 1 and which is adapted to rotate around its central axis 100. The drum 3 is a generally cylindrical body, which comprises flutes 4. The flutes 4 are axially extending recesses in the outer circumferential surface of the drum 3. In particular, the flutes are formed such that they can accommodate and hold the objects 2 therein. Thus, the cross section of the flute may at least partially have a shape which corresponds to the outer shape of the objects, however being slightly larger, such that the objects can still move in the axial direction of the drum 3. When the drum 3 rotates around its central axis 100, the objects 2 are conveyed on the outside of the drum 3 along a first motion path, which corresponds to a circular motion path along the circumference of the drum 3. During this conveying motion, the objects 2 are maintained in a generally fixed position in the flutes 4 of the drum 3, such that they cannot fall out in the radial direction. This may be obtained by the form of the flutes 4, or by further holding means, such as clips or suction holes which apply a lower pressure to the objects 2 to maintain them in the flutes 4. Alternatively, the holding means may be a guide plate that is distanced sufficiently from the drum so as to allow for movement of the objects but prevents the objects from falling out of the flutes during the rotational movement of the drum.

[0035] The drum 3 constitutes the first conveyance means in this embodiment of the invention. The first conveyance means may have an additional cutting feature for separating the objects from each other. This may be implemented by providing knives next to or in the drum. The knives may be stationary such that the rotation of the drum allows for the cutting of the objects. The knives may alternatively be rotating with the drum. Then, an actuator, such as a servo or linear drive, or a cam drive, may provide the cutting motion of the knives. In particular, filter material provided to the drum as a longitudinally extending rod may be cut into individual objects.

[0036] When the objects 2 arrive at the lowest point of the drum 3, they will be removed by a second conveyance means as described in the following, starting with a semifinal product that is separated further into smaller pieces of individual elements.

[0037] The second conveyance means is a chain drive 5, which comprises a first sprocket 6 and a second sprocket 7 and a chain 8 provided in between the two sprockets 6, 7. The extension of the chain 8 is generally aligned with the flute 4 in the lowermost position of the drum 3. Thus, the chain drive 5 generally extends in the axial direction of the drum 3. The chain 8 is provided with two protrusions in the form of fingers 9. The fingers 9 are provided at opposite positions of the chain 8, such that the distance in between the fingers 9 is the same along both directions of the chain 8. The fingers 9 are connected by means of a mechanical transmission to the chain 8, such that the fingers 9 maintain in the orientation even when the corresponding chain links are moving along the first or second sprockets 6, 7 and are thus rotated. The

fingers 9 are adapted to project into the lowermost flute 4 of the drum 3 and move in the axial direction of the drum 3 throughout the flute 4. Thus, the finger 9 engages the rightmost and therefore most upstream object 2 in the flute 4. The most upstream object 2 will then come into contact with the next downstream object 2, and so forth until all objects 2 comprised in the flute 4 are transported together in the axial direction of the drum 3. Thus, in this embodiment the axial direction of the drum 3 constitutes the second motion path.

[0038] In an alternative embodiment, the fingers 9 are adapted to maintain their absolute orientation throughout their movement with the chain 8. This is illustrated by the finger 9 in dashed lines in Fig. 1, which is rotating with respect to the chain link on which it is primarily fixed, when the chain link travels along the sprockets 6,7. Thus, the finger 9 maintains its absolute orientation. This provides the benefit that no further acceleration of the tip of the finger 9 is effected by the rotation of the finger 9 which could otherwise lead to an unsteady conveyance speed of the objects 2 driven by the finger 9 or to the damaging of the filter elements

[0039] At the downstream end of the flute 4 a collecting means 10 is provided. The collecting means 10, depicted in cross section in Figure 1, is a channel, which is slightly widened towards its receiving end 11, which is adjacent to the drum 3. The receiving end 11 is provided close to the drum 3, such that the receiving end 11 and the opening of the flute 4 are substantially aligned. The objects 2 are pushed by means of the finger 9 from the flute 4 into the collecting means 10. The collecting means 10 has preferably a length of about 70 mm.

[0040] The collecting means 10 is rotatable around the substantially upright axis 200. The collecting means 10 is driven in a reciprocating movement around the upright axis 200. The peak-to-peak amplitude angle of the reciprocating movement is preferably small, for example between about 2 and 3 degrees. The reciprocating movement of the collecting means 10 around the upright axis 200 enables that the receiving end 11 can be moved together with the rotation of the drum 3, such that the receiving end 11 is maintained in alignment with the flute 4 even if the drum 3 is rotated during the transition of the objects 2 from the flute 4 to the collecting means 10. In particular, the collecting means 10 are driven in the direction of the rotation of the drum 3 exactly for the time required until all objects 2 are transferred from the flute 4 to the collecting means 10. Then, the collecting means 10 moves in the opposite direction of the movement direction of the drum, such that it is aligned with the next upstream flute 4 in order to receive the objects 2 of the next upstream flute 4. A cam drive 20 is provided to enable the rotating movement of the collecting means 10. The rotation of the drum 3, the chain drive 5 and the cam drive 20 are all synchronized by mechanical or electrical means such that it can be ensured that even at a high conveyance speed a proper alignment and synchronization in between the individual drives is guaranteed. Thus,

the collecting means 10 is adapted to substantially follow the movement of the drum 3 along the first motion path, at least while receiving the objects 2 which are transferred along the second motion path.

[0041] In this embodiment, the collecting means only carries out a reciprocating rotating movement around the upright axis 200. This is sufficient, as the objects 2 are transferred at high speed in little time from the flute 4 to the collecting means 10. Thus the first motion path is almost linear during the transfer. The vertical components of the circular first motion path can be compensated by a slightly widened receiving end portion 11 of the collecting means 10. The main displacement of the flutes 4 due to the rotation of the drum 3 at the lowermost position of the drum 3 occurs in the horizontal direction, in which the collecting means 10 is able to follow the flute 4 due to the rotation around the axis 200.

[0042] Alternatively, the upright axis 200 can be located downstream from the collecting means 10, in particular about 15 mm in the downstream direction of the collecting means 10.

[0043] In the collecting means 10 an air nozzle 12 is provided, which is adapted to provide pressurized air in conveying direction of the objects 2 such that the objects are transported to the downstream end 13 of the collecting means 10.

[0044] Further air stream nozzles may be provided in the collecting means 10, which are not depicted for the sake of clarity.

[0045] In a preferred embodiment, the receiving end portion 11 of the collecting means 10 is in contact with the drum 3 during the removal of the objects 2 from the flute 4 to the collecting means 10.

[0046] Adjacent to the downstream end 13 of the collecting means 10 an upstream set of rollers 14 is provided, comprising of two rollers rotating around parallel horizontal axis. The rollers are in engagement with each other, such that the lower roller drives the upper roller. The rollers have a lower diameter in their central section and a higher diameter in their outer section, as shown in Figure 2, such that the two rollers are only in contact with each other at their axially outer portions, while forming a space in between the rollers which corresponds to the outer shape of the objects 2. The contact areas of the rollers can be provided with a friction increasing material, such that the synchronization of the upper roller with the lower roller is ensured. Alternatively, the rollers could be provided with small teeth, such that the lower roller is in a toothed engagement with the upper roller. As a further alternative, the synchronization of the rollers can be enabled by an external transmission means, such as a belt or chain connection, or via toothed wheels.

[0047] Next to the upstream set of rollers 14 in the conveyance direction of the objects 2 a downstream set of rollers 15 is provided. The lower roller of the downstream set of rollers 15 is in engagement with the upper roller and is adapted to drive the upper roller in the same manner as in the upstream set of rollers 14. The distance in

between the two sets of rollers is adjustable to the length of the objects 2 by moving the downstream set of rollers 15 in the conveyance direction of the objects 2. The distance in between the upstream set of rollers 14 and the downstream set of rollers 15 is adjustable such that the objects 2 will be engaged by the downstream set of rollers 15 at the same time as their engagement ends with the upstream set of rollers 14. Thus, objects 2 which leave the collecting means 10, at the downstream end 13 are first engaged by the upstream set of rollers 14 and conveyed towards the downstream set of rollers 15, which subsequently engages with the objects 2. The downstream set of rollers 15 is driven at a higher speed than the upstream set of rollers 14. Thus, while all objects 2 in the collecting means 10 are in contact with each other, the two sets of rollers 14, 15 with different rotation speeds enable to separate the objects 2, such that the objects 2 are further conveyed with a defined distance in between each other. In one embodiment, the downstream set of rollers are at a speed that is about four times as high as the upstream set of rollers 14, to create space in between the objects 2.

[0048] The upstream set of rollers 14 is driven by a first driving wheel 16, while the downstream set of rollers is driven by a second driving wheel 17. In particular, the driving wheels are driven by a belt drive 18 comprising several belts. The first driving wheel 16 is in engagement with the lower roller of the upstream set of rollers 14. The second driving wheel 17 is in engagement with the lower roller of the downstream set of rollers 15.

[0049] Furthermore, a vertical driving axis 19 is provided which is driven by a cam drive 20. The vertical driving axis is the axis driving the reciprocating movement of the collecting means 10.

[0050] The cam drive 20 is driven by the toothed wheels 21 and 22, such that the movement of the collecting means 10 is synchronized to the movement of the chain drive 5 and the drum 3.

[0051] In Figure 2, a bottom view of the drum 3, chain 8, collecting means 10 and a conveyance disc 23 is shown. It can be seen that all flutes 4 of the drum 3 upstream on the first motion path from the chain 8 are filled with objects 2, while the downstream flutes 4 are emptied. The finger 9 of the chain 8 pushes the objects 2 into the collecting means 10. In the collecting means 10 all objects 2 are in contact with their adjacent upstream and downstream objects 2, as only one finger 9 pushes one set of objects out of the flute 4. The finger 9 of the chain 8 may have a certain flexibility in the circumferential direction of the drum 3 or may be slimmer than the flute 4, such that the drum 3 can continue to turn while the finger 9 moves through the flute 4.

[0052] At the downstream end 13 of the collecting means 10 the upstream set of rollers 14 and the downstream set of rollers 15 is provided, wherein the downstream set of rollers 15 rotates at a higher speed such that a distance in between adjacent objects 2 will be created. As can be seen in Figure 2, the rollers have a low-

ered diameter, to allow the objects 2 to pass in between two rollers. After the downstream set of rollers 15, the individual objects 2 will be engaged each by a finger 24 of a conveyance disc 23 and transported along a curved guiding means 25. The downstream set of rollers 15 is provided with an opening or gap at least at one side in between the rollers in order to allow the finger 24 of the conveyance disc 23 to pass through and take out the objects 2. The speed difference of the two sets of rollers 14, 15 has to be matched, such that the space created in between the objects 2 correlates with the time the finger 24 needs to go in between the objects 2.

[0053] Downstream of the conveyance disc 23 a linear conveyance means 26 is provided which further conveys the objects 2. Additionally, objects 2 may be provided from the upstream section 27 of the linear conveyance means 26 and may be interposed in between the objects 2 provided by the conveyance means 1 according to the invention.

Claims

1. Conveyance apparatus (1) for objects (2), comprising
a first conveyance means (3) with a plurality of holding means (4) for objects, wherein the conveyance means (3) is conveying the objects (2) along a first motion path, and
a second conveyance means (5) for removing the objects (2) from at least one of the holding means (4) of the conveyance means (3) along a second motion path, which is different from the first motion path,
characterized by
a collecting means (10) which is adapted to receive the objects (2) along the second motion path, while being adapted to follow the movement of the first conveyance means (3) along the first motion path while receiving the objects (2) transferred along the second motion path, wherein the collecting means (10) is adapted to move in the direction substantially opposite to the first motion path of the first conveyance means (3) after having received the objects (2) from the at least one holding means (4) of the first conveyance means (3), so as to carry out a reciprocating movement.
2. Conveyance apparatus according to claim 1, wherein the movement velocity of the collecting means (10) in the direction substantially opposite to the first motion path is higher than the movement velocity of the collecting means (10) during following the movement of the first conveyance means (3) along the first motion path.
3. Conveyance apparatus according to claim 1 or 2, wherein the first conveyance means is a drum (3)

rotating around its central axis, and the first motion path is the circumferential direction on the circumference of the drum (3), and wherein the holding means are flutes (4) in the outer circumference of the drum (3), which extend along the second motion path, which is preferably substantially in the axial direction of the drum (3).

4. Conveyance apparatus according to claim 3, wherein suction holes provided with a lower pressure are arranged in the flutes (4) to enable to hold the objects (2) in the flutes (4).
5. Conveyance apparatus according to any one of the previous claims, wherein the collecting means (10) is a channel adjacent to the first conveyance means (3), having a funnel-shaped receiving end portion (11), which is arranged next to the first conveyance means (3) and which is adapted to receive objects (2) moving along the second motion path while following the movement of the first conveyance means (3) along the first motion path.
6. Conveyance apparatus according to claim 5, wherein the channel has a cross-section adapted to the geometry of the objects (2) for substantially maintaining the orientation of a longitudinal axis of the objects (2) in the channel direction.
7. Conveyance apparatus according to any one of the previous claims, wherein the collecting means (10) is mounted by means of a hinge in a distance to the receiving end portion (11), such that the receiving end portion (11) is enabled to follow the movement of the first conveyance means (3) along the first motion path by means of rotating around the hinge.
8. Conveyance apparatus according to any one of the previous claims, wherein each holding means (4) on the first conveyance means (3) holds a plurality of aligned objects (2), and wherein the collecting means (10) is adapted to follow the movement of the first conveyance means (3) while the second conveyance means (5) transfers the plurality of aligned objects (2) from one holding means (4) to the collecting means (10).
9. Conveyance apparatus according to any one of the previous claims, wherein the second conveyance (5) means is a belt or a chain (8) with driving protrusions (9), which are adapted to engage with the objects (2) in the holding means (4) of the first conveyance means (3) and to convey the objects (2) into the collecting means (10).
10. Conveyance apparatus according to any one of the previous claims, wherein at least one air nozzle (12) is provided in the collecting means (10), to supply

pressured air for conveying the objects (2).

11. Conveyance apparatus according to any one of the previous claims, wherein the collecting means (10) comprises a downstream end portion (13), which is adjacent to an upstream set of rollers (14) next to which a downstream set of rollers (15) is arranged, wherein each set of rollers (14, 15) engages the objects (2) from at least two sides, and wherein the upstream set of rollers (14) rotates at a lower velocity than the downstream set of rollers (15), such that objects (2) which were previously adjacent to each other are separated from each other.
12. Conveyance apparatus according to claim 11, wherein the distance in between the upstream set of rollers (14) and the downstream set of rollers (15) is adjustable, to enable to process objects (2) of different length.
13. Method for conveying objects (2), in particular filter elements for smoking articles, comprising the steps of:
 - conveying objects (2) in a plurality of holding means (4) on a first conveyance means (3) along a first motion path,
 - removing all objects (2) from one of the holding means (4) along a second motion path, which is different from the first motion path,
 - collecting the objects (2) by a collecting means (10) which follows the movement of the first conveyance means (3) substantially along the first motion path while receiving the objects along the second motion path, and
 - returning the collecting means (10) by moving same in the direction substantially opposite to the first motion path, such that the collecting means (10) carries out a substantially reciprocating movement.
14. Method according to claim 13, wherein the movement velocity of the collecting means (10) during the step of returning is higher than during the step of collecting the objects (2).
15. Method according to claim 13 or 14, wherein the step of conveying comprises the conveying of objects such that the objects (2) are substantially in contact with the next upstream and downstream object (2) in the collecting means (10), and a defined distance is established in between each of the objects (2) downstream of the collecting means (10).

Patentansprüche

1. Fördervorrichtung (1) für Objekte (2), umfassend

- ein erstes Fördermittel (3) mit mehreren Haltemitteln (4) für Objekte, wobei das Fördermittel (3) die Objekte (2) entlang einer ersten Bewegungsbahn befördert, und ein zweites Fördermittel (5) zum Entfernen der Objekte (2) von mindestens einem von den Haltemitteln (4) des Fördermittels (3) entlang einer zweiten Bewegungsbahn, die sich von der ersten Bewegungsbahn unterscheidet,
- gekennzeichnet durch**
- ein Sammelmittel (10), das angepasst ist, um die Objekte (2) entlang der zweiten Bewegungsbahn aufzunehmen, während es angepasst ist, der Bewegung des ersten Fördermittels (3) entlang der ersten Bewegungsbahn während des Aufnehmens der Objekte (2) zu folgen, die entlang der zweiten Bewegungsbahn übertragen werden, wobei das Sammelmittel (10) angepasst ist, sich im Wesentlichen in der Richtung gegenüber der ersten Bewegungsbahn des ersten Fördermittels (3) zu bewegen, nachdem es die Objekte (2) von dem mindestens einen Haltemittel (4) des ersten Fördermittels (3) aufgenommen hat, um eine Pendelbewegung auszuführen.
2. Fördervorrichtung nach Anspruch 1, wobei die Geschwindigkeit der Bewegung des Sammelmittels (10) in der Richtung im Wesentlichen gegenüber der ersten Bewegungsbahn höher ist als die Geschwindigkeit der Bewegung des Sammelmittels (10) während des Folgens der Bewegung des ersten Fördermittels (3) entlang der ersten Bewegungsbahn.
 3. Fördervorrichtung nach Anspruch 1 oder 2, wobei das erste Fördermittel eine Trommel (3) ist, die sich um ihre Mittelachse dreht, und die erste Bewegungsbahn die Umfangsrichtung an dem Umfang der Trommel (3) ist, und wobei die Haltemittel Rillen (4) im äußeren Umfang der Trommel (3) sind, die sich entlang der zweiten Bewegungsbahn erstrecken, die vorzugsweise im Wesentlichen in der Axialrichtung der Trommel (3) verläuft.
 4. Fördervorrichtung nach Anspruch 3, wobei Saugöffnungen, die mit einem niedrigeren Druck versehen sind, in den Rillen (4) angeordnet sind, um zu ermöglichen, dass die Objekte (2) in den Rillen (4) gehalten werden.
 5. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei das Sammelmittel (10) ein Kanal ist, der an das erste Fördermittel (3) angrenzt, welcher einen trichterförmigen Aufnahmeendeabschnitt (11) aufweist, der neben dem ersten Fördermittel (3) angeordnet und angepasst ist, Objekte (2) aufzunehmen, welche sich die zweite Bewegungsbahn entlangbewegen, während er der Bewegung des ersten Fördermittels (3) entlang der ersten Bewegungsbahn folgt.
 6. Fördervorrichtung nach Anspruch 5, wobei der Kanal einen Querschnitt aufweist, der an die Geometrie der Objekte (2) angepasst ist, um im Wesentlichen die Ausrichtung einer Längsachse der Objekte (2) in der Kanalrichtung aufrechtzuerhalten.
 7. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei das Sammelmittel (10) mittels eines Scharniers in einem Abstand zum Aufnahmeendeabschnitt (11) befestigt ist, sodass dem Aufnahmeendeabschnitt (11) ermöglicht wird, der Bewegung des ersten Fördermittels (3) entlang der ersten Bewegungsbahn mittels Drehen um das Scharnier zu folgen.
 8. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei jedes Haltemittel (4) auf dem ersten Fördermittel (3) mehrere ausgerichtete Objekte (2) hält, und wobei das Sammelmittel (10) angepasst ist, der Bewegung des ersten Fördermittels (3) zu folgen, während das zweite Fördermittel (5) die mehreren ausgerichteten Objekte (2) von einem Haltemittel (4) zu dem Sammelmittel (10) überträgt.
 9. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei das zweite Fördermittel (5) ein Riemen oder eine Kette (8) mit Antriebsvorsprüngen (9) ist, die angepasst sind, um die Objekte (2) in den Haltemitteln (4) des ersten Fördermittels (3) anzugreifen und die Objekte (2) in das Sammelmittel (10) zu befördern.
 10. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei mindestens eine Luftdüse (12) in dem Sammelmittel (10) vorgesehen ist, um Druckluft zum Befördern der Objekte (2) zuzuführen.
 11. Fördervorrichtung nach irgendeinem der vorstehenden Ansprüche, wobei das Sammelmittel (10) einen stromabwärtigen Endabschnitt (13) umfasst, der an einen stromaufwärtigen Satz von Rollen (14) angrenzt, neben dem ein stromabwärtiger Satz von Rollen (15) angeordnet ist, wobei jeder Satz von Rollen (14, 15) die Objekte (2) von mindestens zwei Seiten angreift, und wobei der stromaufwärtige Satz von Rollen (14) mit einer niedrigeren Geschwindigkeit dreht als der stromabwärtige Satz von Rollen (15), sodass Objekte (2), die zuvor aneinander angrenzend waren, voneinander getrennt werden.
 12. Fördervorrichtung nach Anspruch 11, wobei der Abstand zwischen dem stromaufwärtigen Satz von Rollen (14) und dem stromabwärtigen Satz von Rollen (15) einstellbar ist, um zu ermöglichen, dass Objekte (2) von unterschiedlicher Länge verarbeitet werden können.
 13. Verfahren zum Befördern von Objekten (2) und ins-

besondere von Filterelementen für Rauchartikel, das die Schritte umfasst:

- Befördern von Objekten (2) in mehreren Haltemitteln (4) auf einem ersten Fördermittel (3) entlang einer ersten Bewegungsbahn, 5
 - Entfernen aller Objekte (2) von einem der Haltemittel (4) entlang einer zweiten Bewegungsbahn, die sich von der ersten Bewegungsbahn unterscheidet, 10
 - Sammeln der Objekte (2) durch ein Sammelmittel (10), das der Bewegung des ersten Fördermittels (3) im Wesentlichen entlang der ersten Bewegungsbahn folgt, während des Aufnehmens der Objekte entlang der zweiten Bewegungsbahn, und 15
 - Zurückbringen des Sammelmittels (10), indem dieses in der Richtung im Wesentlichen gegenüber der ersten Bewegungsbahn bewegt wird, sodass das Sammelmittel (10) im Wesentlichen eine Pendelbewegung ausführt. 20
14. Verfahren nach Anspruch 13, wobei die Bewegungsgeschwindigkeit des Sammelmittels (10) während des Schritts des Zurückbringens höher ist als während des Schritts des Sammelns der Objekte (2). 25
15. Verfahren nach Anspruch 13 oder 14, wobei der Schritt des Beförderns das Befördern von Objekten umfasst, sodass die Objekte (2) im Wesentlichen in Kontakt mit dem nächsten stromaufwärtigen und stromabwärtigen Objekt (2) in dem Sammelmittel (10) sind und ein definierter Abstand zwischen jedem der Objekte (2) stromabwärts des Sammelmittels (10) hergestellt wird. 30

Revendications

1. Appareil de transport (1) d'objets (2), comprenant un premier moyen de transport (3) doté d'une pluralité de moyens de maintien (4) d'objets, dans lequel le moyen de transport (3) transporte les objets (2) le long d'une première trajectoire de déplacement, et un deuxième moyen de transport (5) sert à retirer les objets (2) d'au moins un des moyens de maintien (4) du moyen de transport (3) le long d'une deuxième trajectoire de déplacement, différente de la première trajectoire de déplacement, 40
- caractérisé par** 45
- un moyen de collecte (10) qui est adapté pour recevoir les objets (2) le long de la deuxième trajectoire de déplacement, tout en étant conçu pour suivre le mouvement du premier moyen de transport (3) le long de la première trajectoire de déplacement tandis qu'il reçoit les objets (2) transférés le long de la deuxième trajectoire de déplacement, dans lequel le moyen de collecte (10) est adapté pour se dépla- 50
- 55

cer dans un sens sensiblement opposé à la première trajectoire de déplacement du premier moyen de transport (3) après avoir reçu les objets (2) en provenance de l'au moins un moyen de maintien (4) du premier moyen de transport (3), de manière à réaliser un mouvement de va-et-vient.

2. Appareil de transport selon la revendication 1, dans lequel la vitesse du mouvement du moyen de collecte (10) dans un sens sensiblement opposé à la première trajectoire de déplacement est supérieure à la vitesse du mouvement du moyen de collecte (10) pendant le suivi du mouvement du premier moyen de transport (3) le long de la première trajectoire de déplacement.
3. Appareil de transport selon la revendication 1 ou 2, dans lequel le premier moyen de transport est un tambour (3) tournant autour de son axe central, et la première trajectoire de déplacement est la direction circonférentielle sur la circonférence du tambour (3), et dans lequel les moyens de maintien sont des cannelures (4) sur la circonférence extérieure du tambour (3), lesquelles s'étendent le long de la deuxième trajectoire de déplacement, laquelle, de préférence, se trouve sensiblement dans la direction axiale du tambour (3).
4. Appareil de transport selon la revendication 3, dans lequel des trous d'aspiration dotés d'une pression inférieure sont disposés dans les cannelures (4) pour permettre de maintenir les objets (2) dans les cannelures (4).
5. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel le moyen de collecte (10) est un canal adjacent au premier moyen de transport (3), comportant une partie d'extrémité de réception en forme d'entonnoir (11) disposée à côté du premier moyen de transport (3) et adaptée pour recevoir des objets (2) se déplaçant le long de la deuxième trajectoire de déplacement tandis qu'elle suit le mouvement du premier moyen de transport (3) le long de la première trajectoire de déplacement.
6. Appareil de transport selon la revendication 5, dans lequel le canal a une section transversale adaptée à la géométrie des objets (2) afin de permettre sensiblement le maintien de l'orientation d'un axe longitudinal des objets (2) dans la direction du canal.
7. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel le moyen de collecte (10) est installé au moyen d'une charnière à une distance de la partie d'extrémité de réception (11), de sorte que la partie d'extrémité de réception (11) puisse suivre le mouvement du premier moyen de transport (3) le long de la première trajectoire de

déplacement grâce à la rotation autour de la charnière.

8. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel chaque moyen de maintien (4) du premier moyen de transport (3) contient une pluralité d'objets (2) alignés, et dans lequel le moyen de collecte (10) est adapté pour suivre le mouvement du premier moyen de transport (3) tandis que le deuxième moyen de transport (5) transfère la pluralité d'objets (2) alignés depuis un moyen de maintien (4) au moyen de collecte (10). 5
9. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel le deuxième moyen de transport (5) est une courroie ou une chaîne (8) munie de protubérances d'entraînement (9), lesquelles sont adaptées pour s'engager avec les objets (2) présents dans le moyen de maintien (4) du premier moyen de transport (3) et pour transférer les objets (2) dans le moyen de collecte (10). 10
10. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel au moins une buse à air (12) est prévue dans le moyen de collecte (10), pour fournir de l'air comprimé afin de permettre le transport des objets (2). 15
11. Appareil de transport selon l'une quelconque des revendications précédentes, dans lequel le moyen de collecte (10) comprend une partie d'extrémité en aval (13), laquelle est adjacente à un ensemble de rouleaux en amont (14) à côté duquel se trouve un ensemble de rouleaux en aval (15), dans lequel chaque ensemble de rouleaux (14, 15) s'engage avec les objets (2) depuis au moins deux côtés, et dans lequel l'ensemble de rouleaux en amont (14) tourne à une vitesse inférieure par rapport à l'ensemble de rouleaux en aval (15), de sorte que les objets (2), qui étaient précédemment adjacents les uns aux autres, sont séparés les uns des autres. 20
12. Appareil de transport selon la revendication 11, dans lequel la distance séparant l'ensemble de rouleaux en amont (14) et l'ensemble de rouleaux en aval (15) est réglable, pour permettre de traiter des objets (2) de différentes longueurs. 25
13. Procédé de transport d'objets (2), en particulier des éléments de filtre pour des articles à fumer, comprenant les étapes suivantes : 30
 - transporter les objets (2) contenus dans une pluralité de moyens de maintien (4) sur un premier moyen de transport (3) le long d'une première trajectoire de déplacement, 35
 - retirer tous les objets (2) d'un des moyens de 40

maintien (4) le long d'une deuxième trajectoire de déplacement, laquelle est différente de la première trajectoire de déplacement,

- rassembler les objets (2) grâce à un moyen de collecte (10) qui suit le mouvement du premier moyen de transport (3) sensiblement le long de la première trajectoire de déplacement tandis qu'il reçoit les objets le long de la deuxième trajectoire de déplacement, et

- renvoyer le moyen de collecte (10) en le déplaçant dans un sens sensiblement opposé à la première trajectoire de déplacement, de manière que le moyen de collecte (10) effectue un mouvement sensiblement de va-et-vient.

14. Procédé selon la revendication 13, dans lequel la vitesse du mouvement du moyen de collecte (10) pendant l'étape où il est renvoyé est supérieure à celle qu'il présente pendant l'étape de collecte des objets (2). 20

15. Procédé selon la revendication 13 ou 14, dans lequel l'étape de transport comprend le transport d'objets de manière à ce que les objets (2) soient sensiblement en contact avec le prochain objet en aval et en amont (2) dans le moyen de collecte (10), et qu'une distance définie soit établie entre chacun des objets (2) en aval du moyen de collecte (10). 25

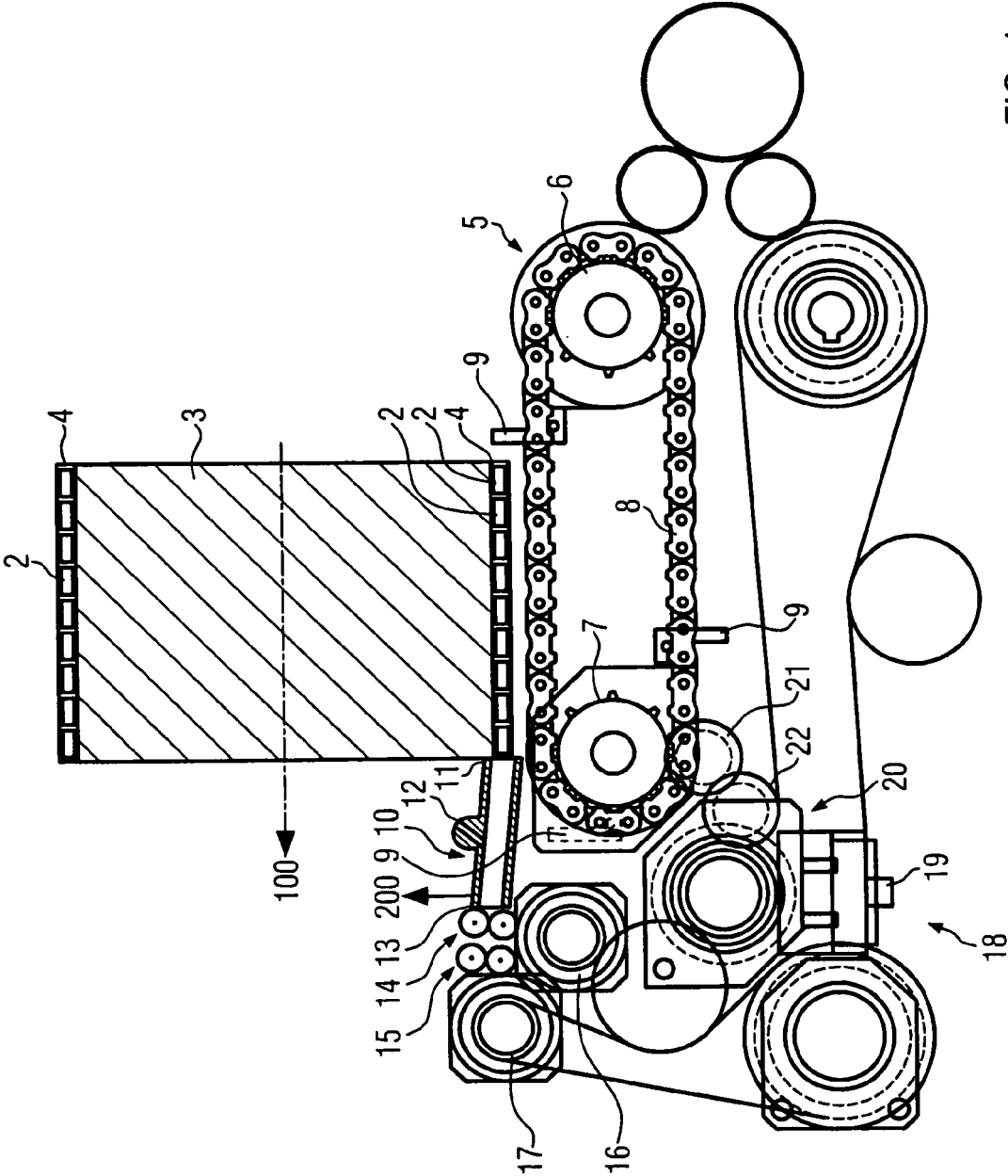


FIG. 1

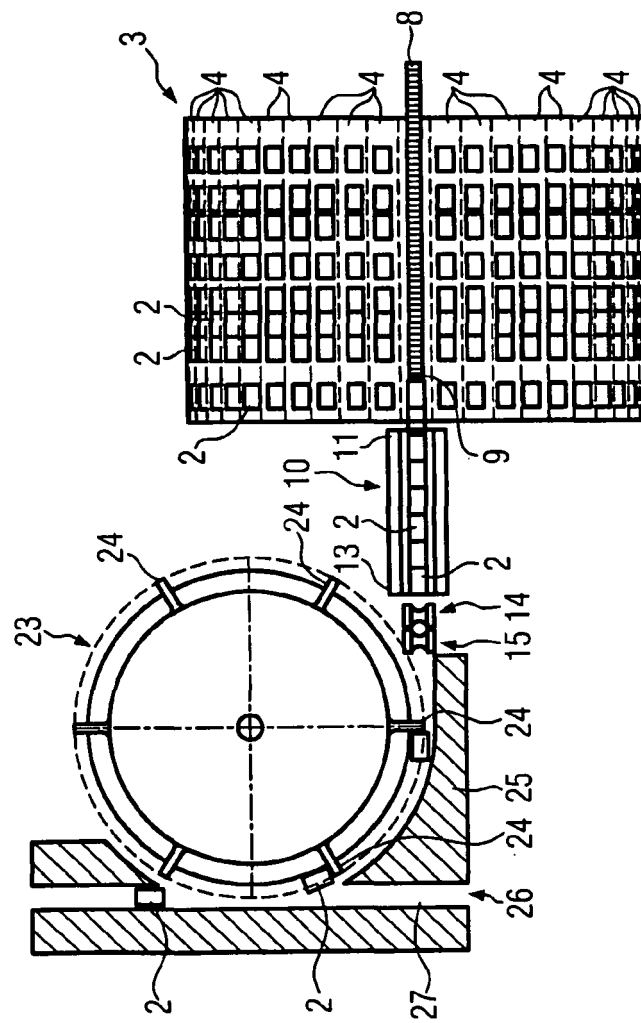


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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