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(54) Title: APPARATUS FOR MANUFACTURING A ROD OF AEROSOLISABLE MATERIAL AND METHOD OF MANUFACTURING A ROD OF AEROSOLISABLE MATERIAL

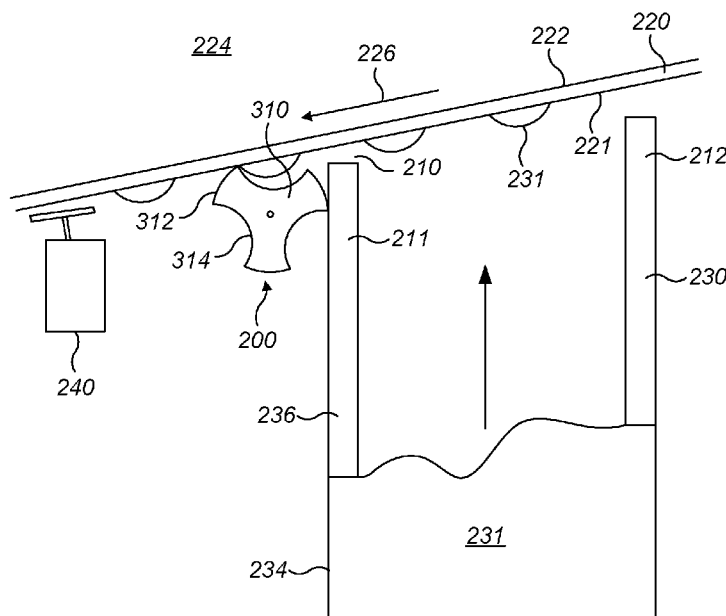


FIG. 10

(57) Abstract: Apparatus for manufacturing a rod of aerosolizable material is disclosed. The apparatus comprises a suction belt (220) for conveying aerosolizable material and a vertical feeder (230) comprising an upper end. The upper end is spaced from the suction belt by a gap (210) and the suction belt (220) and the vertical feeder (230) are configured so that tobacco is lifted from said vertical feeder to form blocks of tobacco on the suction belt that are conveyed by the suction belt through the gap. The apparatus includes a device (200) for reducing the ingress of air through the gap. A method of manufacturing a rod of aerosolizable material is also disclosed.



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Apparatus for Manufacturing a Rod of Aerosolisable Material and Method of Manufacturing a Rod of Aerosolisable Material

Field

- 5 The present invention relates to apparatus for manufacturing a rod of aerosolisable material, for example a tobacco rod for a tobacco industry product, and to a method of manufacturing a rod of aerosolisable material.

Background

- 10 Known apparatus for manufacturing a tobacco rod includes a suction conveyor that draws tobacco material from a vertical tobacco feeder onto a moving suction belt. The tobacco material is entrained on the suction belt and then transferred to a garniture for wrapping with a paper wrap to form a wrapped tobacco rod.

Summary

- 15 In accordance with some embodiments described herein, there is provided an apparatus and method for manufacturing a rod of aerosolisable material as claimed in the claims.
- 20 In exemplary embodiments, the apparatus comprises: a suction belt for conveying aerosolisable material; a vertical feeder comprising an upper end, said upper end being spaced from said suction belt by a gap, the suction belt and vertical feeder being configured so that tobacco is lifted from said vertical feeder to form blocks of tobacco on a portion of said suction belt that are conveyed by the suction belt through the gap;
- 25 and a device for reducing the ingress of air through the gap. The device comprising a member mounted for rotation about an axis transverse to the direction of movement of the suction belt. The member has an outer peripheral surface with a series of circumferentially spaced pockets. The member being mounted so that the outer peripheral surface is positioned relative to the suction belt and to the vertical feeder to close, or minimise, the gap. The member is configured to rotate to enable each tobacco
- 30 block on the suction belt to be matched with a pocket in said member. .
- A control unit may be used to control the rotation of the rotary member so that it rotates in register with the movement of the suction belt. The control unit may be an electronic control unit. Additionally or alternatively, a mechanical link, such as a gear
- 35 train, may be employed.

In the exemplary embodiments a suction is applied to the suction belt in order to lift the tobacco from the vertical feeder. The suction creates a negative pressure behind the suction belt. Suitably a suction chamber is formed to create the negative pressure.

5 Suitably, the outer peripheral surface has zones between the pockets formed with a constant radius from the axis of rotation and the pockets are zones of the outer peripheral surface having a reduced radius from the axis of rotation. Here, the member can be mounted so that the zones between the pockets are arranged in proximity to the vertical feeder. Additionally or alternatively, the member can be mounted so that the
10 zones between the pockets are arranged in proximity to the suction belt. Suitably, the proximity of the respective parts provides a seal against air ingress or at least substantially reduces air ingress between the respective parts as compared to a situation wherein the member was not present.

15 In exemplary embodiments, the outer peripheral surface of each pocket is formed to have a reduced radius to correspond to a shape of the tobacco blocks. Suitably, a length of the circumferential arc of the zones between the pockets corresponds to the distance between spaced tobacco blocks. After a tobacco block has been carried by the belt through the gap, it is received in a pocket in the member so that the member does not
20 disturb the tobacco block on the suction belt.

In exemplary embodiments, the device is arranged at a gap between the suction belt and vertical feeder on a trailing edge of the vertical feeder and alternatively or additionally, the device is arranged at is a gap between the suction belt and vertical
25 feeder on a leading edge of the vertical feeder. Furthermore, a second vertical feeder may be provided and the device may be provided at any gap between the suction belt and a leading or trailing edge of either vertical feeder. Additionally, second or further devices may be arranged in any combination of further gaps between the suction belt and a leading or trailing edge of either vertical feeder.

30 One or more trimmers may be provided to trim said aerosolisable material on the suction belt downstream of a vertical feeder. Trimmers may be provided as a further processing station after the tobacco entrained on the suction belt has exited a vertical feeder. Each trimmer may comprise an ecreteur. The ecreteur may have a pair of
35 counter-rotating disks arranged to trim the aerosolisable material on the suction belt.

The suction belt may be arranged to retain said aerosolisable material on an underside of the suction belt. Aerosolisable material may be supplied to the suction belt at a first region and or a second region. Here, one of the vertical feeders is arranged to feed aerosolisable material onto the suction belt in the first region and the other feeder
5 arranged to feed aerosolisable material onto the suction belt in the second region. In examples, the first and/or second feeder is disposed below the suction belt.

The apparatus may further comprise rollers, and the suction belt may be arranged to run on the rollers such that the suction belt has an upper run and a lower run. The
10 profile belt may be disposed between the upper run and the lower run of the suction belt.

In one example, the apparatus comprises first, second and third rollers, the third roller being disposed between the first roller and the second roller. The suction belt is
15 arranged to run on the first roller and the second roller, and a profile belt is arranged to run on the first roller and the third roller such that the profile belt overlaps the suction belt between the first roller and the third roller.

In another example, the apparatus further comprises first, second, third and fourth
20 rollers. The third and fourth rollers are disposed between the first and second rollers. The suction belt is arranged to run on the first and second rollers and a profile belt is arranged to run on the third and fourth rollers.

In one exemplary embodiment, the profile belt may comprise a plurality of suction
25 regions and a plurality of blocking regions arranged along the length of the profile belt. The blocking regions are adapted to block the corresponding suction holes in the suction belt, and the suction regions permit suction to act through the corresponding suction holes in the suction belt. In some examples, each suction region comprises a plurality of suction holes. Alternatively, each suction region comprises a single
30 aperture. In other examples, the profile belt further comprises connecting suction regions disposed between the suction regions. Each of the connecting suction regions may be smaller than the suction regions such that less aerosolisable material is retained on the suction belt in each connecting suction region than in each suction region. In some examples, each connecting suction region comprises a plurality of suction holes.
35 Alternatively, each connecting suction region comprises a single aperture. In other examples, the profile belt has a higher porosity in the suction regions than in the

blocking regions. For examples, the material of the profile belt may have a higher porosity in the suction regions than in the blocking regions. In other examples, the suction belt has a first width and the profile belt has a second width, and wherein the second width is less than the first width. In this way, the profile belt does not overlap
5 the full width of the suction belt, leaving some suction holes unblocked.

In another exemplary embodiment the suction belt comprises a first suction conveyor arranged to convey a first aerosolisable material, a second suction conveyor arranged to combine the first aerosolisable material with a second aerosolisable material, and an
10 intermediate conveyor arranged to transfer the first aerosolisable material from the first suction conveyor to the second suction conveyor. In some examples, each of the first and second suction conveyors and the intermediate conveyor comprises a suction chamber arranged to provide suction to the respective suction conveyor. Suitably, suction holes of the first suction belt may be arranged in a profile such that the first
15 aerosolisable material is retained on the first suction conveyor in a profile. The apparatus may alternatively comprise a removal drum arranged to remove some of the first aerosolisable material from the intermediate conveyor, such that the first aerosolisable material is arranged in a profile on the intermediate conveyor. Here, the removal drum may comprise a rotor arranged to rotate. The rotor may comprise a
20 plurality of removal passages for removing parts of the first aerosolisable material from the intermediate conveyor. The removal drum may comprise at least one suction extraction tube connected to the removal passages for removal of parts of the first aerosolisable material from the intermediate conveyor. In some examples, the intermediate conveyor may further comprise a suction break chamber arranged to
25 release suction from the first aerosolisable material to transfer the first aerosolisable material from the intermediate suction conveyor to the second suction conveyor. The suction break chamber may comprise an air jet. The air jet may be configured to provide pulses of air flow.

30 In an exemplary embodiment a second or further device is provided at one of the other gaps between a vertical feeder and suction belt. The further device comprises a secondary belt arranged spaced from and opposing the suction belt. A control unit may control the secondary belt so that facing surfaces of the suction and secondary belts move in the same direction. The speed of the suction belt and the secondary belt may be
35 matched. The spacing between the suction belt and secondary belt is equal to or less than the height of the tobacco entrained on the suction belt. Suitably, the secondary

belt is arranged in proximity to the vertical feeder. The secondary belt may also be arranged in proximity to a respective down stream or up stream apparatus such as a further vertical feeder or a trimming device or a further suction belt. Suitably, the proximity of the respective parts provides a seal against air ingress or at least
5 substantially reduces air ingress between the respective parts as compared to a situation wherein the support belt was not present. Suitably, the surface of the secondary belt is substantially flat. However, in an alternative embodiment, the surface of the secondary belt is adapted to include lobes that project towards the suction belt. For instance a plurality of lobes. Here, the lobes are arranged to fit between respective
10 tobacco blocks and therefore further support the tobacco blocks and / or restrict air movement through the gap. Suitably, the lobes may extend to be in proximity to the suction belt. Suitably, the proximity of the lobes to the suction belt provides a seal against air ingress or at least substantially reduces air ingress between the respective parts as compared to a situation wherein the lobes were not present.

15 The apparatus may further comprise a garniture arranged to receive said aerosolisable material from the suction belt. The garniture may be adapted to wrap a ribbon of paper about the aerosolisable material to form a continuous rod of aerosolisable material. In addition, the apparatus may further comprise a cutter adapted to cut the continuous
20 rod of aerosolisable material.

In accordance with some embodiments described herein, there is also provided a method of manufacturing a rod of aerosolisable material, the method comprising: applying suction to a suction belt to lift tobacco from a vertical feeder comprising an
25 upper end, the suction being applied to retain blocks of tobacco on a portion of the suction belt that are conveyed by the suction belt through a gap between said upper end and the suction belt; moving said portion of the suction belt in a direction of movement; causing a member of a device for reducing the ingress of air through said gap to rotate about an axis transverse to the direction of movement of the suction belt,
30 wherein the member has an outer peripheral surface with a series of circumferentially spaced pockets; the method comprising rotating the member such that each tobacco block on the suction belt is matched with a pocket in said member. The member being mounted so that the outer peripheral surface is positioned relative to the suction belt and to the vertical feeder to restrict or close the gap.

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The method may comprise applying suction to a suction belt having suction holes to retain aerosolisable material on the suction belt in a first region and in a second region, the second region being downstream of the first region; blocking some suction holes of the suction belt in the first region such that the aerosolisable material is retained on the suction belt in a profile; and, trimming the aerosolisable material on the suction belt between the first region and the second region.

The method may further comprise transferring the aerosolisable material to a garniture. The method may further comprise wrapping the aerosolisable material in a ribbon of paper to form a continuous rod of aerosolisable material. The method may further comprise cutting the continuous rod of aerosolisable material.

In accordance with some embodiments described herein, there is provided a method of manufacturing a tobacco industry product, the method comprising manufacturing a rod of aerosolisable material according to the method described above, and further comprising combining the rod of aerosolisable material with a further component.

The method may comprise retaining a first aerosolisable material on the suction belt in a first region and retaining a second aerosolisable material on the suction belt in a second region.

The tobacco industry product may be a cigarette. The aerosolisable material may be a tobacco material.

Brief Description of the Drawings

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying Figures, in which:

Figs. 1A to 1D show examples of tobacco industry products that include two different types of tobacco;

Figs. 2A and 2B show examples of wrapped tobacco rods having two different types of tobacco, the wrapped tobacco rods being formed during the manufacture of the tobacco industry products of FIGS. 1A to 1D;

Fig. 3 shows a part of apparatus for manufacturing the example wrapped tobacco rods of Figs. 2A and 2B;

Fig. 4 shows a part of an alternative apparatus for manufacturing the example wrapped tobacco rods of Figs. 2A and 2B;

Figs. 5A and 5B show different examples of the profile belt of the apparatus of Fig. 3 or 4;

Fig. 6A and 6B show two further examples of the profile belt of the apparatus of Fig. 3 or 4;

5 Fig. 7 shows a part of apparatus for manufacturing the example wrapped tobacco rods of Figs 2A and 2B;

Fig. 8 shows a more detailed view of the transfer point from the intermediate suction belt to the second suction belt of the apparatus of Fig. 7;

Fig. 9 shows a more detailed view of the removal drum of the apparatus of Fig. 7.

10 Fig 10 shows a view of a portion of an apparatus for manufacturing the example wrapped tobacco rods having a device for restricting air ingress through a gap; and,

Fig 11 shows a view of a portion of an apparatus for manufacturing the example wrapped tobacco rods having a device for supporting entrained tobacco.

15 Detailed Description

FIGS. 1A to 1D show different examples of tobacco industry products 1. The tobacco industry products 1 include a rod of aerosolisable material that, during use, generates an aerosol for delivery to a user. In the described embodiments, the tobacco industry products are cigarettes, and the rod of aerosolisable material is a tobacco rod 3 that can
20 be combusted or heated to generate an aerosol.

As illustrated, each of the tobacco industry products 1 includes a filter 2 and a tobacco rod 3. The filter 2 may comprise a filtering material and a wrapper, and the tobacco rod 3 comprises tobacco material and a paper wrapper. The filter 2 and the tobacco rod 3
25 may be joined together by a joining wrapper that circumscribes and at least partially overlaps the filter 2 and the tobacco rod 3. For clarity, these details are omitted from FIGS. 1A to 1D, which schematically illustrate the arrangement of first and second tobacco materials 4, 5 in the tobacco rod 3.

30 As illustrated, in these examples the tobacco rods 3 include a first tobacco material 4 and a second tobacco material 5. The first and second tobacco materials 4, 5 are different. The first and second tobacco materials 4, 5 are arranged in distinct areas of the tobacco rod 3, such that a boundary is formed between the first tobacco material 4 and the second tobacco material 5 in the tobacco rod 3, as illustrated.

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In the example of FIG. 1A, the first tobacco material 4 extends from the end of the tobacco rod 3 adjacent to the filter 2, and the second tobacco material 5 extends from the open end 6 of the tobacco rod 3. The boundary between the first and second tobacco materials 4, 5 is angled with respect to the axial direction of the tobacco industry product 1 so that, while using the tobacco industry product 1, there is a gradual transition from the second tobacco material 5 to the first tobacco material 4.

The example of FIG. 1B is similar to that of FIG. 1A, although the first tobacco material 4 extends alongside the second tobacco material 5 to the open end 6 of the tobacco rod 3. In this example, the first tobacco material 4 extends from the filter 2 to the open end 6 of the tobacco rod 3, and overlaps the second tobacco material 5 along a part of the length of the tobacco rod 3.

The examples of FIGS. 1C and 1D are similar to those of FIGS. 1A and 1B, but the first tobacco material 4 and the second tobacco material 5 are oppositely arranged with respect to the filter 2 and the open end 6 of the tobacco rod 3. In these examples, the second tobacco material 5 is located at the end of the tobacco rod 3 abutting the filter 2, and the first tobacco material 4 extends to the open end 6 of the tobacco rod 3.

In other examples, the boundary between the first tobacco material 4 and second tobacco material 5 may be a line that is perpendicular to the longitudinal direction of the tobacco industry product 1 at a location along the length of the tobacco rod 3.

During manufacture of the tobacco industry products 1 a continuous wrapped tobacco rod is formed by wrapping a wrapper about a stream of tobacco material. The stream of tobacco material is formed of first tobacco material 4 and second tobacco material 5 arranged in the appropriate manner for forming the tobacco rods 3. The continuous wrapped tobacco rod is subsequently cut into tobacco rods for the individual tobacco industry products 1 shown in FIGS. 1A to 1D.

FIG. 2A shows an example continuous wrapped rod of aerosolisable material, for example a continuous tobacco industry rod 7. The continuous tobacco industry rod 7 is formed during the manufacture of the tobacco industry products 1 of FIGS. 1A and 1C.

FIG. 2B shows an example continuous wrapped rod of aerosolisable material, for example a continuous tobacco industry rod 7. The continuous tobacco industry rod 7 is formed during the manufacture of the tobacco industry products 1 of FIGS. 1B and 1D.

5 FIGS. 2A and 2B are schematic drawings showing the arrangement of the first and second tobacco materials 4, 5 along the length of the continuous tobacco rods 7, and the lengths and widths illustrated are not dimensionally representative of the actual continuous tobacco rod 7. In particular, the length dimension is compressed and the width dimension is exaggerated to provide a clear illustration of the arrangement of the
10 first and second tobacco materials 4, 5 along the continuous tobacco rod 7.

As shown, the first tobacco material 4 and second tobacco material 5 are arranged in an alternating pattern along the continuous tobacco rods 7. In particular, the first and second tobacco materials 4, 5 are arranged such that it can be cut at regular intervals to
15 form the tobacco rods 3 for the tobacco industry products 1 of FIGS. 1A to 1D. The first and second tobacco materials 4, 5 are arranged such that after the continuous tobacco rod 7 is cut at lines 8 the individual tobacco rods are arranged in an opposing back-to-back manner (i.e. they are mirror-images of each other about the cut line). Cigarette assembly apparatus can then attach the filters 2 in the manner shown in FIGS. 1A to 1D.

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Apparatus for manufacturing the tobacco industry products 1, in particular the tobacco rods 3, is described hereinafter. However, it will be appreciated that the apparatus may be used to manufacture tobacco industry products that include a rod of aerosolisable material that is free from tobacco material, or that includes a material in addition to
25 tobacco material.

FIG. 3 and FIG. 4 are schematic views of example apparatuses 9 for manufacturing a continuous rod of aerosolisable material, for example the continuous tobacco rod 7 of FIGS. 2A and 2B.

30

As shown in FIG. 3 and FIG. 4, the apparatus includes a suction conveyor 10 that includes a suction belt 11. The suction belt 11 is arranged to run on rollers 12, 13 such that it has an upper run 14 and a lower run 15, the lower run 15 moving to the left as illustrated in FIG. 3 and FIG. 4. The lower run 15 of the suction belt 11 receives tobacco
35 material 4, 5 and conveys the tobacco material 4, 5.

The suction belt 11 includes suction holes that draw tobacco material 4, 5 onto the suction belt 11 and retain tobacco material 4, 5 on the suction belt 11 for conveyance. Guides may be provided to guide the tobacco material 4, 5 along the suction conveyor 10 as the suction belt 11 moves.

5

The suction holes are arranged in a continuous pattern along the suction belt 11. As explained below, suction is applied through the suction holes in the suction belt 11 to retain tobacco material 4, 5 on the suction belt 11 during use. The suction holes are sized such that the tobacco material 4, 5 is retained on the underside of the lower run 15 of the suction belt 11 by the suction.

As illustrated in FIG. 3 and FIG. 4, the suction belt 11 receives a first tobacco material 4 in a first region 17, and a second tobacco material 5 in a second region 18. The second region 18 is downstream of the first region 17. That is, the lower run 15 of the suction belt 11 pass through the second region 18 after having passed through the first region 17. In this way, the suction belt 11 is provided with a combined stream of first and second tobacco materials 4, 5.

In various examples, described below, the first tobacco material 4 is formed into a profile on the suction belt 11 before the second tobacco material 5 is added to the suction belt 11, such that the combined stream of first and second tobacco materials 4, 5 are arranged in a profile for manufacturing a continuous tobacco rod, such as the continuous tobacco rod 7 illustrated in FIG. 2A or 2B.

As shown in FIG. 3 and FIG. 4, a profile belt 19 is arranged to overlap a part of the suction belt 11. The profile belt 19 is disposed between the upper and lower runs 14, 15 of the suction belt 11, and has a lower run 20 that is in contact with a part of the lower run 15 of the suction belt 11. Specifically, the profile belt 19 overlaps the suction belt 11 in the first region 17, where the first tobacco material 4 is received on the suction belt 11.

In the example of FIG. 3, the profile belt 19 runs on roller 12 and roller 21. Both the suction belt 11 and the profile belt 19 run on roller 12 (with the suction belt 11 outermost), and roller 21 is located between the upper and lower runs 14, 15 of the suction belt 11.

In the example of FIG. 4, the profile belt 19 runs on roller 36 and roller 37, which are separate to rollers 12 and 13. Rollers 36, 37 are disposed between the upper and lower runs 14, 15 of the suction belt 11.

- 5 In the examples of FIGS. 3 and 4, the profile belt 19 is disposed such that a lower run 20 of the profile belt 19 contacts the lower run 15 of the suction belt 11 and overlaps the suction belt 11 in the first region 17.

Referring to figures 5A to 5D, the profile belt 19 has suction regions 22 arranged in a
10 profile along the profile belt 19. Blocking regions 47 are disposed between the suction regions 22. Different examples of the profile belt 19 are illustrated in FIGS. 5A to 5B, and in FIGS. 6A and 6B. As explained further below, the suction regions 22 and blocking regions 47 are arranged to limit the suction provided to the suction holes on the suction belt 11. In particular, the blocking regions 47 of the profile belt 19 blocks at
15 least some of the suction holes to prevent first tobacco material 4 being retained by those suction holes, and the suction regions 22 do not block other suction holes such that first tobacco material 4 is retained by those suction holes. In this way, a profile of first tobacco material 4 is provided on the suction belt 11 according to profile of suction regions 22 and blocking regions 47 in the profile belt 19.

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In the example of FIG. 5A, a plurality of suction regions 22 are spaced along the length of the profile belt 19. Each suction region 22 comprises a plurality of suction holes 23. Suction holes on the suction belt 11 that are aligned with, or at least partially aligned with, the spaced suction regions 22 on the profile belt 19 will be provided with suction
25 in the first region 17 during use, while the suction holes on the suction belt 11 that are aligned with the blocking regions 47 during use will be blocked, preventing suction from acting through these suction holes. In this way, first tobacco material 4 is only retained on the suction belt 11 in the profile of the suction regions 22 on the profile belt 11.

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In the example of FIG. 5B, the profile belt 19 includes a plurality of suction regions 22 spaced along the length of the profile belt 19, as per FIG. 5A. Each suction region 22 comprises a plurality of suction holes 23. In this example, the suction belt 19 includes connecting suction regions 25 formed of one or more suction holes 26 disposed
35 between the suction regions 22, in the blocking regions 47. In this way, a lesser amount of first tobacco material 4 is retained on the suction belt 11 in the areas corresponding

to the connecting suction regions 25 than in the areas corresponding to the suction regions 22 formed by the spaced groups of suction holes 23 in the profile belt 19.

The example profile belts 19 of FIGS. 6A and 6B are similar to those of FIGS. 5A and 5B, respectively, but each suction region 22 is formed of a single aperture 27 in the profile belt 19, rather than as a group of suction holes 23 as per FIGS. 5A and 5B. In the example of FIG. 6B the connecting suction regions 28, between each suction region 22, are formed of a single aperture in the profile belt 19, which are smaller than the apertures 27 forming the suction regions 22.

In an alternative example, the profile belt 19 may have a width that is less than the width of the suction belt 11. In this example, the profile belt 19 may not include any suction regions, or it may have suction regions like those described with reference to FIGS. 5A and 5B, and in FIGS. 6A and 6B. In this way, in the first region 17 the profile belt 19 only blocks some of the suction holes 16 in the suction belt 16, allowing the non-blocked suction holes 16 to retain first tobacco material 4.

In an alternative example, the profile belt 19 has areas of higher porosity and areas of lower porosity. For example, the profile belt 19 may have suction regions corresponding to the suction regions 22 of FIGS. 5A and 5B, and of FIGS. 6A and 6B, formed by providing the profile belt 19 with a higher porosity in the suction regions 22 compared to a lower porosity in regions corresponding to the blocking regions 47. The variations in porosity of the profile belt 19 can be achieved by using different materials in different regions of the profile belt 19, or by changing the material of the profile belt 19, for example a thinner material or a looser weave of a woven material will provide a higher porosity. Alternatively or additionally, the profile belt 19 is formed of a laminate, and one of the layers of the laminate has varying porosity, varying thickness, or holes formed in it such that the porosity of the profile belt 19 is higher in the suction regions 22 than in the blocking regions 47.

As illustrated in FIG. 3 and FIG. 4, a first vertical feeder 29 is arranged to feed the first tobacco material 4 onto the suction belt 11 in the first region 17, and a second vertical feeder 30 is arranged to feed the second tobacco material 5 onto the suction belt 11 in the second region 18.

The first and second vertical feeders 29, 30 each have a vertical chimney 31 that receives first and second tobacco materials 4, 5, respectively. The tobacco material 4, 5 is fed into the bottom of the vertical chimney 31 and is urged upwards towards the suction conveyor 10. The first vertical feeder 29 is disposed beneath the lower run 15 of the suction belt 11 in the first region 17. The second vertical feeder 30 is disposed beneath the lower run 15 of the suction belt 11 in the second region 18, downstream of the first region 17. Optionally, air flow is induced within the vertical chimneys 31 of the first and/or second vertical feeders 29, 30 to urge the tobacco material 4, 5 vertically upwards towards the suction belt 11.

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Suction is provided to the suction belt 11 by at least one suction chamber 32, which is connected to a vacuum pump via an outlet 33. The suction chamber 32 is located between the upper and lower runs 14, 15 of the suction belt 11.

As illustrated in FIG. 3 and FIG. 4, in some examples a second suction chamber 34 may be provided within the profile belt 19, to provide suction to the suction belt 11 in the first region 17. However, it will be appreciated that a single suction chamber may be arranged to provide suction to the full length of the suction belt 11, in the first and second regions 17, 18.

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In the first region 17, suction acts through the suction holes in the suction belt 11 and the suction regions 22 in the profile belt 19 to draw the first tobacco material 4 onto the underside of the lower run 15 of the suction belt 11 as the suction belt 11 passes over the first vertical feeder 29. Subsequently, as the suction belt 11 passes over the second vertical feeder 30 in the second region 18 suction acts through the suction holes in the suction belt 11 to draw the second tobacco material 5 onto the underside of the lower run 15 of the suction belt 11.

As briefly described above, the profile of suction regions 22 and blocking regions 47 in the profile belt 19 is adapted to block some of the suction holes in the suction belt 11 in the first region 17. In this way, first tobacco material 4 is retained on the suction belt 11 only where the suction holes are not blocked by the profile belt 19. Therefore, the profile of suction regions 22 on the profile belt 19 determines the profile of first tobacco material 4 retained on the suction belt 11.

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As the lower run 15 of the suction belt 11 moves out of the first region 17, all of the suction holes in the suction belt 11 are uncovered. As the suction belt 11 moves over the second vertical feeder 30, the second tobacco material 5 is drawn onto, and retained on, the suction belt 11. The second tobacco material 5 is retained on the suction belt 11 in
5 areas where there is no, or less, first tobacco material 4. In this way, a combined stream of first and second tobacco materials 4, 5 is formed on the suction belt 11.

As shown in FIG. 3 and in FIG. 4, the first tobacco material 4 on the suction belt 11 may be trimmed by a first trimmer unit 38. The first trimmer 38 can include an ecreteur
10 having a pair of counter-rotating blades 39 that are spaced from the suction belt 11 so that they trim the first tobacco material 4 to an appropriate thickness and/or shape. Alternatively or additionally, the first trimmer 38 can include a paddle wheel that rotates and knocks first tobacco material 4 off of the suction belt 11.

15 As shown in FIG. 3 and FIG. 4, the first trimmer 38 is disposed between the first region 17 and the second region 18, i.e. downstream of the first region 17 and upstream of the second region 18, so that the first tobacco material 4 is trimmed to the appropriate thickness before the second tobacco material 5 is added to the suction belt 11. A recycling device 40 may be arranged to collect first tobacco material 4 that is trimmed
20 by the first trimmer 38 and recycle it to the first vertical feeder 29.

In further examples, the combined stream of first and second tobacco materials 4, 5 on the suction belt 11 may be trimmed by a second trimmer 41. The second trimmer 41 can include an ecreteur having a pair of counter-rotating blades 42 that are spaced from the
25 suction belt 11 so that they trim the first and/or second tobacco materials 4, 5 to an appropriate thickness. Alternatively or additionally, the second trimmer 41 can include a paddle wheel that rotates and knocks tobacco material 4, 5 off of the suction belt 11. Depending on the arrangement of the first and second tobacco materials 4, 5 on the suction belt 11, one or both of the first and second tobacco materials 4, 5 may be
30 trimmed by the second trimmer 41. The second trimmer 41 is disposed downstream of the second region 18, i.e. after the second vertical feeder 30.

The second trimmer 41 may include a recycling device 43 arranged to collect tobacco material 4, 5 that is trimmed by the second trimmer 41. If only one type of the first and
35 second tobacco materials 4, 5 is trimmed from the suction belt 11, then that trimmed tobacco material 4, 5 can be recycled to the first or second vertical feeders 29, 30, as

appropriate. If the trimmed tobacco is a mix of first and second tobacco materials 4, 5, then the trimmed tobacco material can be recycled for alternative uses, for example in different tobacco industry products.

5

At the end of the suction conveyor 10 the combined stream of first and second tobacco materials 4, 5 is transferred to a garniture 44. As illustrated in FIG. 3 and FIG. 4, the suction conveyor 10 is angled at a downwards slope towards the garniture 44. The skilled person will be aware of suitable existing garnitures, but a brief description of the
5 garniture 44 is provided below.

The garniture 44 comprises a continuous garniture belt 45 that drives a ribbon of paper 46 through the garniture 44. The garniture belt 45 is disposed below the ribbon of paper 46, and the combined stream of first and second tobacco materials 4, 5 is
10 transferred from the suction conveyor 10 onto the ribbon of paper 46. In this way, the tobacco material 4, 5 is arranged on the ribbon of paper 46, which is moved through the garniture 44 by the garniture belt 45. At the end of the lower run 15 of the suction belt 11, where the garniture 44 is located, no suction is provided to the suction belt 11 such that the tobacco materials 4, 5 are released from the suction belt 11 for transfer to the
15 garniture 44.

An adhesive applicator (not illustrated) applies adhesive to the top of the ribbon of paper 46 along one side. The garniture 44 includes a wrapping unit (not illustrated) through which the ribbon of paper 46 with the combined stream of first and second
20 tobacco materials 4, 5 is conveyed. The wrapping unit wraps the ribbon of paper 46 about the tobacco materials 4, 5 and the adhesive glues the ribbon of paper 46 in place to form a continuous tobacco rod, for example a continuous tobacco rod 7 as illustrated in one of FIGS. 2A and 2B.

25 The continuous tobacco rod 7 is then cut to the appropriate length for forming tobacco industry products, for example the tobacco industry products 1 shown in FIGS. 1A to 1D. In various examples, the continuous tobacco rod 7 is cut on the tobacco rod making machine and/or on subsequent assembly apparatus. In various examples, the continuous tobacco rod 7 can be cut into double-length rods, quadruple-length rods,
30 and so on, and transferred to an assembly machine for further cutting and combining with a filter to produce complete tobacco industry products. In examples, this can be referred to as a 'two-up' or 'four-up' manufacturing process.

Advantageously, the suction conveyor 10 and the first and second vertical feeders 29,
35 30 can be produced by modification of conventional apparatuses already used in the tobacco product industry. For example, the Hauni Protos cigarette making machine

includes a vertical feeder and suction conveyor arrangement, commonly known as a 'V.E'. This machine can be modified to be used as the apparatus described with reference to the examples. For example, modification might include replacement of the suction belts, modification of the suction chambers, and/or addition of trimmers.

5

FIG. 7 is a schematic diagram of part of a further apparatus 9 for manufacturing a continuous rod 7 of aerosolisable material, for example a continuous tobacco rod, for example the continuous tobacco rods 7 of FIGS. 2A and 2B. Like parts have been given the same reference number and a detailed description omitted. The apparatus 9
10 includes a suction conveyor 10 having a first suction conveyor 112, a second suction conveyor 113, and an intermediate suction conveyor 114. The first suction conveyor 112 receives a first tobacco material 4, and that first tobacco material 4 is transferred to the intermediate suction conveyor 114. The intermediate suction conveyor 114 then transfers the first tobacco material 4 to the second suction conveyor 113. A second
15 tobacco material 5 is added to the second suction conveyor 113 to create a stream of tobacco material comprising the first and second tobacco materials 4, 5.

In various examples, described below, the first tobacco material 4 is formed into a profile on the first suction conveyor 112 and/or on the intermediate suction conveyor
20 114. The profiled first tobacco material 4 is then transferred, in profile, to the second suction conveyor 113. The second tobacco material 5 is then provided to form a stream of first and second tobacco materials 4, 5 suitable for forming a continuous tobacco rod 7, for example the continuous tobacco rod 7 of FIG. 2A or 2B.

25 A first vertical feeder 29 provides the first tobacco material 4 to a first suction conveyor 112. A second vertical feeder 30 provides the second tobacco material 5 to a second suction conveyor 113. The first and second vertical feeders 29, 30 each have a vertical chimney 31 that receives first and second tobacco materials 4, 5, respectively. The tobacco material 4, 5 is fed into the bottom of the vertical chimney 31 and is urged
30 upwards towards the suction conveyors 112, 113.

As explained further below, the suction conveyors 112, 113 include suction holes that draw the tobacco material 4, 5 onto the suction conveyors 112, 113. Optionally, air flow is induced within the vertical chimneys 31 to urge the tobacco material 4, 5 vertically
35 upwards towards the first and second suction conveyors 112, 113.

The first suction conveyor 112 has a first suction belt 116 that is driven on rollers 119 such that the first suction belt 116 has an upper run 117 and a lower run 118, the lower run 118 moving to the left as illustrated in FIG. 7. The first vertical feeder 29 is disposed beneath the lower run 118 of the first suction belt 116.

5

The first suction conveyor 112 also has a suction chamber 120 located between the upper and lower runs 117, 118 of the first suction belt 116. The suction chamber 120 is a closed box (or similar) defining a closed area within the first suction conveyor 112, and has one or more openings on its lower side, adjacent to the lower run 118 of the first
10 suction belt 116. The suction chamber 120 is connected to a vacuum pump via an outlet 121.

The first suction belt 116 includes suction holes formed through the first suction belt 116. Therefore, a suction air flow is induced by the vacuum pump from the chimney 31
15 of the first vertical feeder 29, through the suction holes in the first suction belt 116, into the suction chamber 120 and outlet 121. This suction air flow urges the first tobacco material 4 onto the underside of the lower run 118 of the first suction belt 116. The suction holes are sized such that the first tobacco material 4 is retained on the underside of the lower run 118 of the first suction belt 116 by the suction. In this way,
20 the first tobacco material 4 is entrained on the first suction conveyor 112. Guides may be provided to guide the first tobacco material 4 along the first suction conveyor 112 as the first suction belt 116 moves.

The first suction belt 116 is driven to rotate about rollers 119 to carry first tobacco
25 material 4 towards the intermediate suction conveyor 114 on the underside of the lower run 118 of the first suction belt 116. As explained hereinafter, the first tobacco material 4 is then transferred from the first suction conveyor 112 to the intermediate suction conveyor 114.

30 The intermediate suction conveyor 14 has an intermediate suction belt 122 that is driven on rollers 123 such that the intermediate suction belt 122 has an upper run 124 and a lower run 125.

The intermediate suction conveyor 114 also has a suction chamber 126 located between
35 the upper and lower runs 124, 125 of the intermediate suction belt 122. The suction chamber 126 is a closed box (or similar) defining a closed area within the intermediate

suction conveyor 114, and has one or more openings on its upper side, adjacent to the upper run 124 of the first suction belt 116. The suction chamber 126 is connected to a vacuum pump via an outlet 127.

5 The intermediate suction belt 122 includes suction holes formed through the intermediate suction belt 122. Therefore, a suction air flow is induced by the vacuum pump from the outside atmosphere above the intermediate suction conveyor 114, through the suction holes in the intermediate suction belt 122, into the suction chamber 126 and outlet 127. After the first tobacco material 4 is transferred from the first suction conveyor 112 to the intermediate suction conveyor 114, the suction air flow acts to hold
10 the first tobacco material 4 onto the upper side of the upper run 124 of the intermediate suction belt 122. The suction holes are sized such that the first tobacco material 4 is retained on the intermediate suction belt 122 by the suction.

15 As illustrated, the intermediate suction belt 122 is arranged to partially overlap a portion of the first suction belt 116 in a first transfer region 128. In the first transfer region 128 the intermediate suction belt 122 is disposed below the first suction belt 116, such that the lower run 118 of the first suction belt 116 is above the upper run 124 of the intermediate suction belt 122. In the first transfer region 128 the first tobacco material
20 4 is transferred from the first suction conveyor 112 to the intermediate suction conveyor 114. The suction chamber 120 of the first suction conveyor 112 is adapted to block vacuum to the suction holes on the first suction belt 116 in the first transfer region 128, such that the first tobacco material 4 is released from the first suction belt 116. The suction chamber 126 of the intermediate suction conveyor 114 is arranged to provide
25 suction for the intermediate suction belt 122 in the first transfer region 128. In this way, the first tobacco material 4 is transferred from the first suction belt 116 to the intermediate suction belt 122 in the first transfer region 128.

The intermediate suction belt 122 rotates about rollers 123 to carry first tobacco
30 material 4 towards the second suction conveyor. As explained hereinafter, the first tobacco material 4 is transferred from the intermediate suction conveyor 114 to the second suction conveyor 113.

The second suction conveyor 113 has a second suction belt 129. The second suction belt
35 may be substantially in accordance with the suction belt 11 herein described. As shown, the second suction belt is driven on rollers 130 such that the second suction belt 129 has

an upper run 131 and a lower run 132. The second vertical feeder 30 is disposed beneath the lower run 132 of the second suction belt 129.

5 The second suction conveyor 113 also has a suction chamber 133 located between the upper and lower runs 131, 132 of the second suction belt 129. The suction chamber 133 is a closed box (or similar) defining a closed area within the second suction conveyor 113, and has one or more openings on its lower side, adjacent the lower run 132 of the second suction belt 129. The suction chamber 133 is connected to a vacuum pump via an outlet 134. The second suction belt 129 includes suction holes formed through the
10 second suction belt 129.

The first tobacco 4 is transferred from the intermediate suction belt 122 onto the second suction belt 129 in a second transfer region 135.

15 As illustrated, the second suction belt 129 is arranged to partially overlap a portion of the intermediate suction belt 122 in the second transfer region 135. In the second transfer region 135 the second suction belt 129 is disposed below the intermediate suction belt 122, such that the lower run 132 of the second suction belt 129 is above the upper run 124 of the intermediate suction belt 122. In the second transfer region 135
20 the first tobacco material 4 is transferred from the intermediate suction conveyor 114 to the second suction conveyor 113. The suction chamber 126 of the intermediate suction conveyor 114 is adapted to block vacuum to the suction holes on the intermediate suction belt 122 in the second transfer region 135, such that the first tobacco material 4 is released from the intermediate suction belt 122. The suction chamber 133 of the
25 second suction conveyor 113 is arranged to provide suction to the second suction belt 129 in the second transfer region 135. In this way, the first tobacco material 4 is transferred from the intermediate suction belt 122 to the second suction belt 129 in the second transfer region 135.

30 FIG. 8 schematically illustrates the second transfer region 135, where the first tobacco material 4 is transferred from the intermediate suction belt 122 to the second suction belt 129. It will be appreciated that inverting the arrangement illustrated in FIG. 8 results in the first transfer region 128, and so the below description is relevant to both the first and second transfer regions 128, 135.

35

As shown, the first tobacco material 4 on the intermediate suction belt 122 is arranged in a profile of spaced groups of first tobacco material 4. This is explained further hereinafter. However, it will be appreciated that the first tobacco material 4 may be arranged in any format on the intermediate suction belt 122. For example, the first
5 tobacco material 4 may have a constant or variable thickness on the intermediate suction belt 122.

The suction chamber 126 of the intermediate suction conveyor 114 has an end wall approximately aligned with the roller 130 of the second suction conveyor 113, at the
10 start of the second transfer region 135. The end wall 137 defines the extent of the suction chamber 126, such that after the intermediate suction belt 122 has passed the end wall 137 no (or very little) suction is provided to the suction holes on the intermediate suction belt 122. In this way, the first tobacco material 4 is released from the intermediate suction belt 122 in the second transfer region 135.

15 Preferably, an outlet 138 is provided within the intermediate suction conveyor 114. The outlet 138 can be vented to atmosphere, so that any residual vacuum from the suction chamber 126 is released. Alternatively, the outlet 138 may be provided with a positive air flow to counteract any residual suction from the suction chamber 126 and/or to
20 push the first tobacco material 4 off of the intermediate suction belt 122, towards the second suction belt 29.

As illustrated, in the second transfer region 135 the second suction belt 129 is disposed above the intermediate suction belt 122. The suction chamber 133 extends over the
25 second transfer region 135. Therefore, as the first tobacco material 4 is released from the intermediate suction conveyor 122 it is drawn onto the second suction conveyor 113.

Thereafter, the second suction belt 129 with the first tobacco material 4 moves across the top of the second vertical feeder 30, as illustrated in FIG. 7, and the second tobacco
30 material 5 is added to the second suction belt 129.

Suction air flow induced by the vacuum pump creates air flow from the chimney 31 of the second vertical feeder 30, through the suction holes in the second suction belt 129, into the suction chamber 133 and outlet 134. This suction air flow draws the second
35 tobacco material 5 onto the underside of the lower run 132 of the second suction belt 129, where the first tobacco material 4 provided from the intermediate suction conveyer

114 is also retained. The suction holes are sized such that the first and second tobacco materials 4, 5 are retained on the underside of the lower run 132 of the second suction belt 129 by the suction. In this way, the second tobacco material 5 is added to the first tobacco material 4 and together they are entrained on the second suction conveyor 113.

5 Guides may be provided to guide the first tobacco material 4 and second tobacco material 5 along the second suction conveyor 113 as the second suction belt 129 moves.

In this way, the second suction belt 129 is provided with a combination of the first tobacco material 4 and the second tobacco material 5. The second suction belt 129
10 rotates about rollers 130 to carry the stream of first and second tobacco materials 4, 5 towards a garniture 44.

As illustrated in FIG. 7, the first, second and intermediate suction conveyors 112, 113, 114 are angled at a downwards slope towards the garniture 44. The suction belts 116,
15 122, 129 are parallel to each other and angled downwards in the direction that the tobacco materials 4, 5 move during use.

As briefly described above, the first tobacco material 4 may be evenly arranged on the intermediate suction belt 122, or it may have variable thickness on the intermediate
20 suction belt 122.

In one example, illustrated in FIG. 7, the first tobacco material 4 is arranged in spaced groups along the intermediate suction belt 122. In another example, the first tobacco material 4 may be arranged along the intermediate suction belt 122 with spaced thicker
25 parts and intermediate thinner parts. In these examples, the second tobacco material 5 will fill in the gaps between the spaced areas of first tobacco material 4, thereby creating an arrangement of the tobacco materials 4, 5 suitable for forming the continuous tobacco rods 7 of FIGS. 2A and 2B.

30 To arrange the first tobacco material 4 into spaced groups, a removal drum 39 may be provided on the intermediate suction conveyor 14, as illustrated in FIG. 7. The removal drum 139 is configured to remove parts of the first tobacco material 4 from the intermediate suction belt 122 such that the first tobacco material 4 is arranged in a profile on the intermediate suction belt 122. The profiled first tobacco material 4 is then
35 transferred onto the second suction conveyor 113 in that profile, as previously described.

The removal drum 139 is shown in more detail in FIG. 9. The removal drum 139 includes a rotor 140 that rotates above the upper run 124 of the intermediate suction belt 122, such that the circumferential surface 141 of the rotor rolls over the
5 intermediate suction belt 122 as the intermediate suction belt 122 moves.

As illustrated, the rotor 140 includes a plurality of removal passages 142 spaced about the circumferential surface 141 of the rotor 140. The removal passages 142 are connected to a suction extraction tube 143 so that as a removal passage 142 meets the
10 intermediate suction belt 122 during rotation of the rotor 140, first tobacco material 4 that is aligned with the removal passages 142 is removed from the intermediate suction belt 122. Tobacco that is not aligned with a removal passage 142 remains on the intermediate suction belt 122.

15 Therefore, the arrangement of the removal passages 142 about the rotor 140 determines the profile of the first tobacco material 4 on the intermediate suction belt 122 downstream of the removal drum 139.

In some examples, the rotor 140 may contact the intermediate suction belt 122 as the
20 rotor 140 rotates. In other examples, the rotor 140 may be spaced from the intermediate suction belt 122.

In the example illustrated in FIG. 9, the removal passages 142 are configured to remove all of the first tobacco material 4 from the intermediate suction belt 122 in the region
25 that they align with during rotation. However, in other examples the removal passages 142 may be configured to remove only part of the first tobacco material 4, so that some is left on the intermediate suction belt 122, creating a profile of first tobacco material 4 having varying thickness along the intermediate suction belt 122.

30 The proximity of the rotor 140 to the intermediate suction belt 122 and/or the power of the suction provided to the removal passages 142 can be configured to determine how much of the first tobacco material 4 is removed from the intermediate suction belt 122.

Preferably, the suction extraction tube 143 is adapted to recycle the removed first
35 tobacco material 4 into the first vertical material feeder 10.

In an alternative example, the removal drum 139 is adapted to remove first tobacco material 4 from the intermediate suction belt 122 by pushing parts of the first tobacco material 4 off of the intermediate suction belt 122. For example, the rotor may include a series of angled blades that push first tobacco material 4 off of the side of the intermediate suction belt 122. In this example, the removal drum may rotate about an axis that is rotated in the plane of the intermediate suction belt 122 such that the angled blades push the first tobacco material 4 off of the intermediate suction belt 122. The removed first tobacco material 4 can be collected and recycled to the first vertical feeder 29.

As illustrated in FIG. 9, a suction break chamber 144 may be disposed below the intermediate suction belt 122. The suction break chamber 144 is aligned with the position at which the removal passages 142 (or removal blades) are closest to the intermediate suction belt 122 - i.e. the location where first tobacco material 4 is removed.

In one example, the suction break chamber 144 is sealed from the suction chamber 126, so that no suction is applied to the first tobacco material 4 as it is removed from the intermediate suction belt 122.

Alternatively, the suction break chamber 144 may not be sealed from the suction chamber 126, but may be provide with an air jet 145 that intermittently directs air flow onto the underside of the intermediate suction belt 122 to counteract the suction of the suction chamber 126 while first tobacco material 4 is removed. The air jet 145 is timed to coincide with the removal passages 142 (or removal blades).

In another example, the suction break chamber 144 is sealed from the suction chamber 126 and it may also include an air jet 145 that intermittently directs air flow onto the underside of the intermediate suction belt 122. The air jet 145 is timed to coincide with the removal passages 142 (or removal blades).

Additionally or alternatively to the removal drum 139, a profiled stream of first tobacco material 4 can be created on the intermediate suction conveyor 14 by forming the first suction belt 116 to be configured as a profile belt 19 as herein described.

Referring also to FIG. 7, if the profiled suction belt 19 is used as the first suction belt 116 the first tobacco material 4 from the first vertical feeder 10 is retained on the first suction belt 116 only in the suction regions 22, where the suction holes 23 are located.

- 5 If the profiled suction belt 19 is used as the intermediate suction belt 122, first tobacco material 4 is only transferred onto the intermediate suction conveyor 114 at locations corresponding to the suction regions 22.

10 In another example, the profiled suction belt 19 may be used as both of the first suction belt 116 and the intermediate suction belt 122. In this example, the first and intermediate suction conveyors 112, 114 are coordinated such that the suction regions 22 in each of the first and intermediate suction belts 116, 122 are aligned with each other in the first transfer region 128.

- 15 In a further example, a removal drum 139 like that described with reference to FIG. 9 may be provided on the intermediate suction conveyor 114, in addition to use of a profiled suction belt 19 as the first suction belt 116 and/or the intermediate suction belt 122. The removal drum 139 can remove any excess first tobacco material 4 to ensure an accurate profile of first tobacco material on the intermediate suction conveyor 114.

20

As described above, a profiled suction belt 19 and/or a removal drum 139 can be used to arrange the first tobacco material 4 in a profile along the intermediate suction belt 122, which is then transferred to the second suction belt 129. The second suction belt 129 has suction holes along its full length, or as previously described, so that the second tobacco material 5 is retained on the second suction belt 129 in areas where no, or less, first tobacco material 4 is present. In this way, the first and second tobacco materials 4, 5 form a profiled stream of tobacco material 4, 5 that can be wrapped in the garniture to form the continuous wrapped tobacco rods 7 described with reference to FIGS. 2A and 2B.

30

It will be appreciated that aspects of the profiled suction belt 19 and/or a removal drum 139 can be adapted such that the first and second tobacco materials 4, 5 can be arranged in various profiles along the second suction conveyor 113.

- 35 As shown in FIG. 7, the first tobacco material 4 may be trimmed by a first trimming unit 38. Additionally or alternatively, the combined first and second tobacco materials

4, 5 on the second suction belt 129 may be trimmed by a second trimming unit 41. The first and / or second trimming units 38, 41 may be substantially as herein described.

The arrangement described above and illustrated in FIG. 3 and 7 creates a tobacco stream having two different tobacco materials 4, 5. However, one or more additional vertical feeders, suction conveyors, and intermediate suction conveyors (along with appropriate suction belts / removal drums) could be arranged in series to create a stream of tobacco material having three or more different types of tobacco material arranged in a profile.

Moreover, by placing the same type of tobacco material in the first and second vertical feeders 29, 30 the apparatus could be used to produce a tobacco rod having a single type of tobacco material. This is advantageous as it gives flexibility in the manufacturing process – i.e. the apparatus can be employed to produce various formats of tobacco rod, having one or more different types of tobacco material.

As described above, the combined stream of first and second tobacco materials 4, 5 is transferred from the second suction conveyor 113 into a garniture 44.

Advantageously, the first and second vertical feeders 29, 30 and first and second suction conveyors 112, 113 can be produced by modification of conventional apparatuses already used in the tobacco product industry. For example, the Hauni Protos cigarette making machine includes a vertical feeder and a suction conveyor arrangement, commonly known as a 'V.E'. This machine can be adapted to be used as the first vertical feeder 29 and first suction conveyor 112 described with reference to the examples. This machine can also be adapted to be used as the second vertical feeder 31 and second suction conveyor 113 described with reference to the examples. For example, modification might include replacement of the suction belts, modification of the suction chambers, and/or addition of trimming units. Two of the modified machines can be combined in the described manner by provision of the intermediate suction conveyor 114 and/or addition of the removal drum 139.

The above examples include a suction conveyor having a suction belt for conveying aerosolisable material. In each instance, the suction belt is arranged above a vertical feeder and extends from above the vertical feeder to stations downstream of the vertical feeder such that the tobacco entrained on the suction belt passes through a gap between

an upper end of the vertical feeder and the suction belt. As explained herein, the tobacco is entrained on the suction belt by generating a suction airflow through the suction belt. The suction air flow can cause air to be drawn into the vertical feeder through the gap between the upper end of the vertical feeder and the suction belt. In
5 some instances, the air being drawn through the gap disrupts the tobacco entrained on the suction belt. Consequently, tobacco is caused to be dislodged from being entrained on the suction belt and / or being moved relative to the suction belt thereby causing an irregularity in the distribution of the tobacco on the suction belt.

10 With reference to Figure 10 and 11, a device 200 is hereby disclosed for reducing the ingress of air through a gap 210 of an apparatus for manufacturing a rod of aerosolisable material. The gap 210 is formed between a suction belt and vertical feeder. For instance, in Figures 3, 4 and 7 a gap 210 is formed between a housing of the vertical feeder and the respective suction belts at a leading and trailing edge of each
15 vertical feeder 29, 30. That is, in Figure 3, a gap 210 is formed between a top edge of the vertical chimney 31 of the first vertical feeder 29 at a leading and trailing edge with respect to the direction of travel of the suction belt 15. Additionally, a gap 210 is formed between the suction belt 15 and the leading and trailing edges of the chimney 31 of the second vertical feeder 30. Likewise, in Figure 4, gaps 210 are formed between
20 the housing of the vertical feeders 29, 30 and the suction belt 15. That is the gaps 210 are formed at leading and trailing edges of the first and second vertical feeders and between the suction belt 15 and respective vertical chimneys 31. In figure 7, gaps 210 are formed between the first vertical feeder 29 and the first suction conveyor 112. Here, the gaps are formed between the suction conveyor 112 and leading and trailing edges of
25 the vertical feeder 29, for instance between leading and trailing edges of the vertical chimney 31. Further gaps 210 are formed between the second suction conveyor 113 and the housing of the second vertical feeder 30. For instance between the suction conveyor 113 and leading and trailing edges of the vertical chimney 31.

30 It will be appreciated that the gap 210 is typically formed between a suction belt and an edge of a vertical chimney 31. In the arrangement of a vertical feeder, the tobacco is entrained by suction on to the suction belt in an upwards movement of the tobacco. Typically, the gap is therefore formed between a lower run of the suction belt. Whilst the device 200 for reducing the ingress of air through the gap 210 is suited to
35 implementation in apparatuses as herein described and in particular to use with suction conveyors and suction belts as herein described, the device 200 will be

described in further detail in relation to a suction belt 220 that may form part of the above or other described apparatuses. Generally, the suction belt 220 is air-permeable in which air is able to pass from a feeder side of the belt 221 to an opposed side of the belt 222. As will be appreciated from the above, the suction belt 220 may be air-
5 permeable by the formation of a plurality of apertures formed through the suction belt 220.

In exemplary embodiments a suction means is provided to draw air through the suction belt 220. For instance the suction means may be a suction chamber 224 arranged to
10 act on the opposed side 222 of the belt to the feeder side 221. Alternatively, the suction means may be an air inlet to an air movement device, such that the air movement device creates a negative pressure at the air inlet to provide the suction to the belt. It will be appreciated the suction means may be any of the suction chambers herein described.

15 Whilst the device 200 is suited for use with vertical feeders 29, 30 as herein described, the device will be described in relation to a general vertical feeder 230 containing tobacco 231. Typically the vertical feeder 230 includes a housing 234. For instance, the housing might provide a chimney stack 236 to guide the tobacco 231 as it moves
20 upwards towards the suction belt 220. The gap 210 is formed between a distal end of the housing 234 and the suction belt 220. For instance between an upper edge of the formed chimney and the feeder side 221 of the suction belt 220. In the exemplary embodiments, a gap 210 is formed at a leading and trailing edge of the vertical feeder. Here, the gap 210 extends across the suction belt 220 transverse the direction of
25 movement of the suction belt.

The suction belt is shown in Figure 10 wherein a portion of the suction belt is shown as moving from right-to-left following movement arrow 226. As explained herein, said portion of the suction belt 220 is arranged to move in a slight downwardly direction as
30 it carries the entrained tobacco 231. As shown, the portion of the suction belt moves from the vertical feeder 230 towards a further processing station 240. For instance, the further processing station 240 may be an ecreteur as herein described or a further vertical feeder or a garniture or another processing station.

35 The device 200 is shown arranged on the trailing edge 211 of the vertical feeder 230. However, it will be appreciated that should tobacco be entrained on the belt as it enters

the vertical feeder; the device may additionally or alternatively be arranged on the leading edge 212 of the vertical feeder.

Referring to Figure 9, a device 200 is described in more detail. The device 200 is
5 arranged to reduce ingress of air through the gap 210. The device 200 includes a member 310 and a control unit (not shown) for controlling the member 310. The control unit may be an electronic control, for instance to electronically control the movement of a part, or the control unit may be a mechanical linkage, for instance a gear train. The member 310 has an outer peripheral surface 312. Here, the outer peripheral
10 surface of the member 310 includes alternating zones to provide spaced pockets 314. That is, each spaced pocket is formed by a zone of the peripheral surface that is spaced further from the belt 220 than the spacing between the belt 220 and peripheral surface 312 of the zones to either side.

15 In use, the member 310 is arranged to be moved by the control unit. The movement of the member 310 is configured to match the movement of the portion of the suction belt on which tobacco is entrained such that each pocket 314 of the member 310 moves with a corresponding block of tobacco 231 entrained on the belt 220. In the exemplary
embodiments, the zones of the peripheral surface to either side of a pocket are arranged
20 to be spaced in proximity to the suction belt 220. In exemplary embodiments the proximity may be to touch or press against the suction belt 220. As shown in Figure 10, in exemplary embodiments, the member 310 is additionally arranged so that the peripheral surface of zones to either side of a pocket are moved to be spaced in
proximity to a part of the vertical feeder 234. In figure 10, the peripheral surface of the
25 zones to either side of a pocket are arranged to be in proximity to the chimney 236 of the vertical feeder, and specifically at a location spaced from the distal end of the chimney. In the exemplary embodiments, the zones of the peripheral surface to either side of a pocket are arranged to be spaced in proximity to the vertical feeder. In
exemplary embodiments the proximity may be to touch or press against the vertical
30 feeder.

As explained above, by arranging the peripheral surface of the zones between and to either side of a pocket to be closely spaced to the suction belt 220 and vertical feeder 234, the gap 210 is arranged to be closed or restricted in use. Meanwhile, by arranging
35 the control unit to move the member 310 so that the pockets accommodate and move with the entrained tobacco, the gap is opened to allow the entrained streams of profiled

tobacco to exit the vertical feeder through the gap 210. By closing or restricting the gap 210 when the entrained streams of profiled tobacco are not exiting the gap, the ingress of air drawn through the gap 210 due to the negative air pressure generated by the suction chamber is reduced. As will be appreciated, by reducing the air ingress through the gap, disruption to the tobacco entrained on the belt is reduced and therefore
5 produces a more consistent tobacco profile. Furthermore, the pockets 314 can act as forms that act to mould the entrained tobacco, yet further improving the consistency of the tobacco profile.

10 In the exemplary embodiments the member 310 forms a continuous surface such that, in use, alternate zones are continuously provided to enable pockets to match the profiled stream of entrained tobacco. For instance, as shown in Figure 10, a continuous peripheral surface is provided by the control unit rotating the member 310. For instance, as shown in Figure 10, the member 310 is provided as a rotor mounted for
15 rotation about an axis transverse to the direction of movement of the suction belt 220. Here, the control unit rotates to rotor to match the velocity of the peripheral surfaces to either side of a pocket with the velocity of the suction belt. It will be appreciated, the size of the pocket is arranged to accommodate each block of tobacco entrained on the suction belt. Furthermore, the size of the rotor and the number of pockets 314 is
20 arranged to match the size of zones between pockets to the spacing between the blocks of entrained tobacco on the suction belt 220.

When formed as a rotor, the member 310 is formed to have a generally circular cross-section with a specified radius, wherein the outer peripheral surface of the zones to
25 either side of the pockets 314 are formed along the circular profile, with the common radius. The pockets 314 are formed by zones having the outer peripheral surface formed to have a smaller radius than the specified radius of the zones to either side. The pockets are shown in Figure 10 to have an arcuate profile. However, the profile is arranged to accommodate the tobacco blocks and in some embodiments to closely
30 follow the profile of the tobacco block and the profile of the pocket is designed accordingly.

As will be appreciated, the device 200 as shown in Figure 10 can be arranged to restrict the air flow between a gap between a suction belt and vertical feeder as herein
35 described. However, the device is particularly suited to use with the apparatus as

described in relation to Figures 1 to 9 and wherein the tobacco exiting or entering the vertical feeder is entrained on the suction belt as profiled blocks of tobacco.

With reference to Figure 11, a further exemplary embodiment of a device 200 is
5 described in more detail. The first device 200 is arranged in proximity to the gap, which, as will be herein described reduces the disruption on the tobacco caused by air ingress through the gap 210 of the apparatus for manufacturing a rod of aerosolisable material. A first device 200 is shown on the trailing edge 211 of a first vertical feeder 230 containing tobacco 231. The trailing edge is defined with reference
10 to the direction of travel of the suction belt 220 depicted in Figure 11 by arrow 226. The first device is shown in proximity to the gap 230 formed between the distal end of the housing 234 and specifically, the distal end of the chimney stack 236 and the suction belt 220. The first device may also be arranged in proximity to the further processing station 240. That is, as shown in Figure 11, the first device 200 extends between the
15 gap 210 formed between the suction belt and the vertical feeder and a gap formed between the suction belt and further processing station 240. In exemplary embodiments, the surface of the support belt extends a distance greater than a spacing between said blocks of tobacco. Here, a downstream block of tobacco provides an additional baffle to air ingress for an upstream block of tobacco passing through the
20 gap.

In the exemplary embodiment, the first device 200 includes an endless surface 410 in the form of a secondary conveyor. A portion of the endless surface 410 faces the suction belt 220 and is spaced from the suction belt so as to provide a separation
25 between the two to accommodate the tobacco. That is, the endless surface is arranged to face and be opposed to the feeder side 221 of the suction belt 220. The endless surface 410 is controlled by a control unit (not shown) to move said portion of the endless surface in the direction of movement of the portion of the suction belt on which tobacco is entrained. The control unit may be an electronic control, for instance to
30 electronically control the movement of a part, or the control unit may be a mechanical linkage, for instance a gear train. In Figure 11, the direction of movement is indicated by arrow 226. Suitably, the speed of movement of the portion of the endless surface 410 is matched to the speed of movement of the portion of the suction belt. By matching the speeds, a point on the surface of the suction belt 220 and a point on the
35 endless surface directly opposite the point on the suction belt move in parallel relative to a direction orthogonal to the direction of movement 226.

The first device 200 reduces the disruption of the tobacco entrained on the suction belt and caused by air ingress through the gap by supporting the tobacco 231 on the suction belt 220 as the tobacco exits from the vertical feeder 230. In one embodiment, as
5 explained above, the endless surface extends to proximity to the further processing station 240. Thus the first device 200 supports the tobacco on the suction belt between the vertical feeder and the further station. In the exemplary embodiments, the endless surface supports the tobacco on the suction belt by pressing the tobacco. Here, the spacing may be equal to the height of a tobacco block. Alternatively, the endless surface
10 410 is arranged to be spaced from the suction belt a distance less than a thickness of the tobacco entrained on the suction belt. Thus, the tobacco entrained on the suction belt is compressed between the suction belt and the endless surface. The spacing of the endless surface from the suction belt controls the level of compression of the tobacco. The level of compression is arranged to allow the tobacco to move between the suction
15 belt and endless surface. That is, the level of compression and therefore resistance to movement is not so great as to prevent the tobacco from moving through the space. Compressing the tobacco on the suction belt provides a resistive force on the tobacco to resist disruption caused by air ingress through the gap 210. Typically, the gap will be minimised so that the gap allows the tobacco to pass between the vertical feeder and
20 suction belt without excessive further space. Thus, the portion of the endless surface facing the suction belt will be spaced less than a height of the gap. Here, the height of the gap is the distance between the vertical feeder and the suction belt measured in a direction orthogonal to the direction of movement of the portion of the suction belt.

25 Suitably, the endless surface 410 may be a support belt, for instance a belt similar to the suction belt. The belt may or may not have a corresponding porous profile. Additionally or alternatively, the belt may include lobes or projections from the substantially flat portion of the endless belt, wherein the lobes fit between the tobacco blocks. For instance, the lobes may provide a similar function to the zones between
30 pockets of the herein described embodiment. Various configurations will be readily understood for supporting the belt. For instance, supporting rollers positioned at either end of the support belt, wherein driving the rotation of one or both of the rollers causes the endless belt to move.

35 Optionally, as shown in Figure 11, an additional second device 200 may be provided between the further station 240 and a yet further station arranged in the direction of

travel of the suction belt. For instance, the yet further station may be an intermediate belt or a second vertical feeder. In Figure 11, the yet further station is shown as a second vertical feeder 230. Here, the second device 200 is arranged in close proximity to a gap formed between the leading edge 238 of the second vertical feeder 230. The second device 200 is substantially in accordance with the first device 200 and will not therefore be described in detail. However, as described above, optionally the second device 200 is also arranged in close proximity to the further station 240, which is shown in Figure 11 as an ecreteur.

10 As explained herein, the device 200 is suitable for reducing the disruption of tobacco entrained on the suction belt as the tobacco exits or enters a vertical feeder. Thus, the additionally, the second device 200 shown in figure 11 may be an alternative placement for the first device 200.

15 The device 200 described in relation to an endless surface 410 is suitable for supporting profiled blocks of tobacco. However, it is particularly suitable for supporting combined streams of tobacco, for instance the combined streams of tobacco of the exemplary apparatus as described herein in relation to Figures 3 and 7. Furthermore, the device 200 described in relation to an endless surface of Figure 11 may be used in conjunction
20 with the device 200 described in relation a rotary member of Figure 10. For instance and in particular when used in conjunction with an apparatus of Figure 3 or Figure 7, the rotary type of device may be used at gap 210 between the trailing edge of the first vertical feeder and the leading edge of the second vertical feeder when profiled blocks of tobacco are entrained, and an endless surface type device may be use at the trailing
25 edge of the second vertical feeder where a combined stream of tobacco is entrained. Alternative combinations arte envisaged.

As used herein, the term 'aerosolisable material' includes materials that provide volatilised components upon heating, typically in the form of vapour or an aerosol. In some examples, as described above, the aerosolisable material includes a tobacco material. In other examples, the aerosolisable material consists of a tobacco material, or a blend of different tobacco materials. In other examples, the aerosolisable material is free from tobacco material. The apparatus described herein may be used to manufacture a rod of any aerosolisable material.

In various examples, the first and second tobacco materials 4, 5 are different tobacco materials. For example, the first and second tobacco materials 4, 5 may have different types of tobacco leaf (e.g. burley, oriental, Virginia), or different blends of these different types of tobacco leaf. Alternatively or additionally, the first and second tobacco materials 4, 5 may have tobacco that is dried, cured or treated differently (e.g. flue-cured, air-cured etc.). Alternatively or additionally, the first and second tobacco materials 4, 5 may have different additives. Additives may include, for example flavourants (e.g. menthol) in the form of granules or liquid additives, burn rate modifiers, smoke modifiers etc. Alternatively or additionally, the first and second tobacco materials 4, 5 may include tobacco substitutes, for example reconstituted tobacco materials, or blends of tobacco substitutes with tobacco materials.

A tobacco industry product refers to any item made in, or sold by the tobacco industry, typically including a) cigarettes, cigarillos, cigars, tobacco for pipes or for roll-your-own cigarettes, (whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco or tobacco substitutes); b) non-smoking products incorporating tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco or tobacco substitutes such as snuff, snus, hard tobacco, and heat-not-burn (HnB) products; and c) other nicotine-delivery systems such as inhalers, aerosol generation devices including e-cigarettes, lozenges and gum. This list is not intended to be exclusive, but merely illustrates a range of products which are made and sold in the tobacco industry. In one example, tobacco industry product is not a conventional cigarette.

As used herein, the term “tobacco industry product” is intended to include smoking articles comprising combustible smoking articles such as cigarettes, cigarillos, cigars, tobacco for pipes or for roll-your-own cigarettes, (whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, tobacco substitutes or other smokable material), electronic smoking articles such as e-cigarettes, heating devices that release compounds from substrate materials without burning such as tobacco heating products, hybrid systems to generate aerosol from a combination of substrate materials, for example hybrid systems containing a liquid or gel or solid substrate; and aerosol-free nicotine delivery articles such as lozenges, gums, patches, articles comprising breathable powders and smokeless tobacco products such as snus and snuff.

In one embodiment, the tobacco industry product is a smoking article for combustion, selected from the group consisting of a cigarette, a cigarillo and a cigar.

In one embodiment, the tobacco industry product is a non-combustible smoking article.

5 In one embodiment the tobacco industry product is a heating device which releases compounds by heating, but not burning, an aerosolisable substrate material. The aerosolisable substrate material may be for example tobacco or other non-tobacco products, which may or may not contain nicotine. In one embodiment the heating device is a tobacco heating device. In one embodiment, the apparatus or method is used
10 to manufacture a consumable for a heating device.

In another embodiment the tobacco industry product is a hybrid system to generate aerosol by heating, but not burning, a combination of aerosolisable substrate materials. The aerosolisable substrate materials may comprise for example solid, liquid or gel
15 which may or may not contain nicotine. In one embodiment, the hybrid system comprises a liquid or gel substrate and a solid substrate. The solid substrate may be for example tobacco or other non-tobacco products, which may or may not contain nicotine. In one embodiment the hybrid system comprises a liquid or gel substrate and tobacco.

20 The various embodiments described herein are presented only to assist in understanding and teaching the claimed features. These embodiments are provided as a representative sample of embodiments only, and are not exhaustive and/or exclusive. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects described herein are not to be considered limitations
25 on the scope of the invention as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claimed invention. Various embodiments of the invention may suitably comprise, consist of, or consist essentially of, appropriate combinations of the disclosed elements, components, features, parts, steps, means, etc,
30 other than those specifically described herein. In addition, this disclosure may include other inventions not presently claimed, but which may be claimed in future.

Claims

1. Apparatus for manufacturing a rod of aerosolisable material, the apparatus comprising:
 - 5 a suction belt for conveying aerosolisable material;
a vertical feeder comprising an upper end, said upper end being spaced from said suction belt by a gap, the suction belt and vertical feeder being configured so that tobacco is lifted from said vertical feeder to form blocks of tobacco on said suction belt that are conveyed by the suction belt through the gap;
 - 10 a device for reducing the ingress of air through the gap, the device comprising a member having an outer peripheral surface with a series of circumferentially spaced pockets, the member being mounted for rotation about an axis transverse to the direction of movement of the suction belt and so that said outer peripheral surface is positioned relative to the suction belt and to the vertical feeder to close the gap;
 - 15 wherein the member is configured to rotate to enable each tobacco block on the suction belt to be matched with a pocket in said member.
2. The apparatus of Claim 1, wherein the outer peripheral surface has zones between the pockets formed with a constant radius from the axis of rotation and the
20 pockets are zones of the outer peripheral surface having a reduced radius from the axis of rotation.
3. The apparatus of Claim 2, wherein the member is mounted relative to the vertical feeder so that the zones between the pockets successively move into a position
25 in which they prevent or minimise the passage of air between the member and the vertical feeder.
4. The apparatus of Claim 2 or Claim 3, wherein the member is mounted relative to the suction belt so that the zones between the pockets successively move into a position in which they prevent or minimise the passage of air between the member and the suction belt.
30
5. The apparatus of any of Claims 2 to 4, wherein the outer peripheral surface of the pockets is formed to have a reduced radius to correspond to a shape of the tobacco blocks.

6. The apparatus of any of Claims 2 to 4, wherein a length of the circumferential arc of the zones between adjacent pockets is configured to correspond to a distance between spaced tobacco blocks on the suction belt.
- 5 7. The apparatus of any of Claims 1 to 6, wherein the device is arranged at the gap between the suction belt and vertical feeder on a trailing edge of the vertical feeder and alternatively or additionally, wherein the device is arranged at a leading edge of the vertical feeder.
- 10 8. The apparatus of any of Claims 1 to 7, wherein the suction belt comprises a profiled suction belt having at least a first area and a second area, wherein the first area and the second area have different porosities so as to entrain said blocks of tobacco on the suction belt.
- 15 9. The apparatus of any of Claims 1 to 8, wherein a second vertical feeder is spaced from the suction belt such that the suction belt receives aerosolisable material at a first region and at a second region, the second region being downstream of the first region and optionally wherein the or a further device for reducing ingress of air through a gap is arranged between a leading and / or trailing edge of the second vertical feeder and
20 the suction belt.
10. The apparatus of Claim 9, wherein a profile belt is arranged to overlap the suction belt in the first region, the profile belt being configured to block some of the suction holes in the suction belt such that said aerosolisable material is retained on the
25 suction belt in a profile.
11. The apparatus of Claim 9, wherein the suction belt comprises a first suction conveyor arranged to convey a first aerosolisable material from the first vertical feeder, a second suction conveyor arranged to combine the first aerosolisable material with a
30 second aerosolisable material via the second vertical feeder, and an intermediate conveyor arranged to transfer the first aerosolisable material from the first suction conveyor to the second suction conveyor.
12. The apparatus of any of claims 1 to 11, wherein a first and or a second trimmer is
35 arranged to trim said aerosolisable material on the suction belt, the trimmer being disposed downstream of the device or each device.

13. The apparatus of any of Claims 1 to 12, further comprising a garniture arranged to receive said aerosolisable material from the suction belt.

5 14. The apparatus of any of Claims 1 to 12, wherein the apparatus includes a control unit for controlling said rotation of the rotary member in register with movement of the suction belt.

15. A method of manufacturing a rod of aerosolisable material, the method
10 comprising:
applying suction to a suction belt to lift tobacco from a vertical feeder comprising an upper end, the suction being applied to retain blocks of tobacco on the suction belt that are conveyed by the suction belt through a gap between said upper end of the vertical feeder and the suction belt;

15 causing a member of a device for reducing the ingress of air through said gap to rotate about an axis transverse to the direction of movement of the suction belt, wherein the member has an outer peripheral surface with a series of circumferentially spaced pockets, the member being mounted so that said outer peripheral surface is positioned relative to the suction belt and to the vertical feeder to close the gap;

20 the method comprising rotating the member such that each tobacco block on the suction belt is matched with a pocket in said member.

16. The method of claim 15 comprising using an apparatus of any of claims 1 to 14.

25

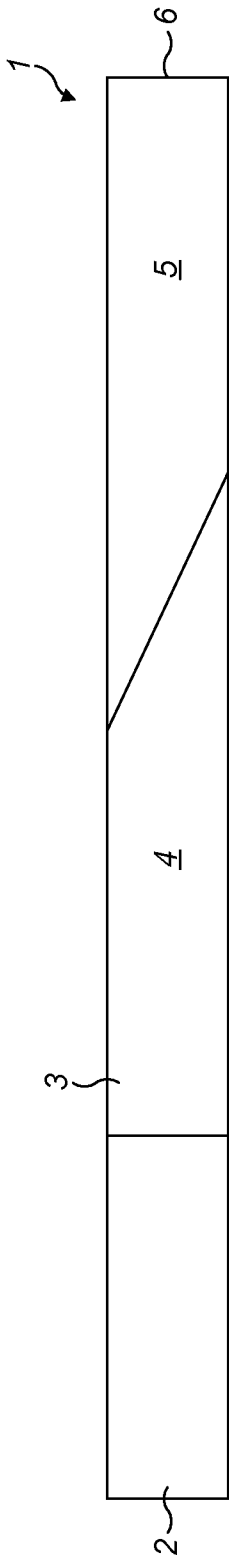


FIG. 1A



FIG. 1B

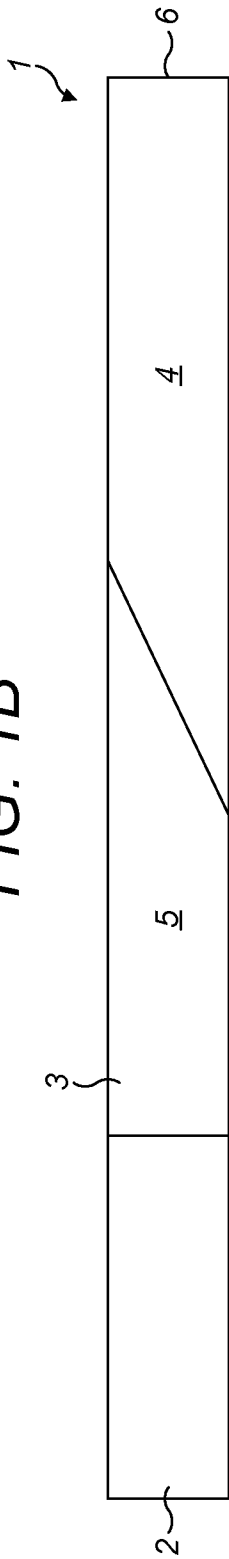


FIG. 1C

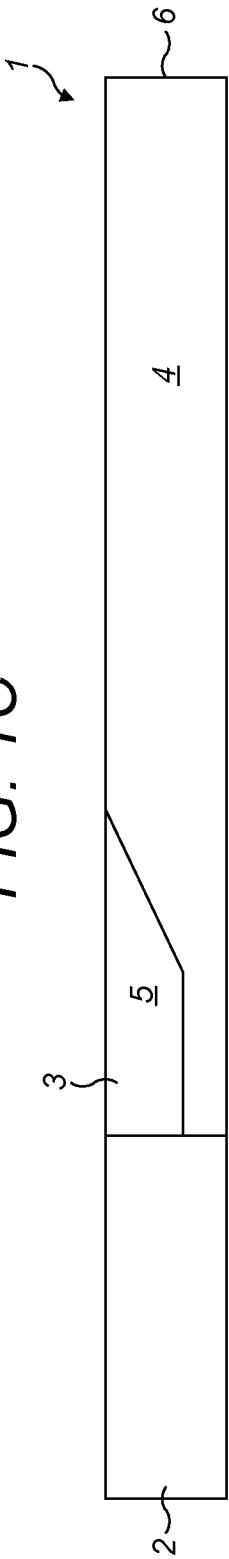


FIG. 1D

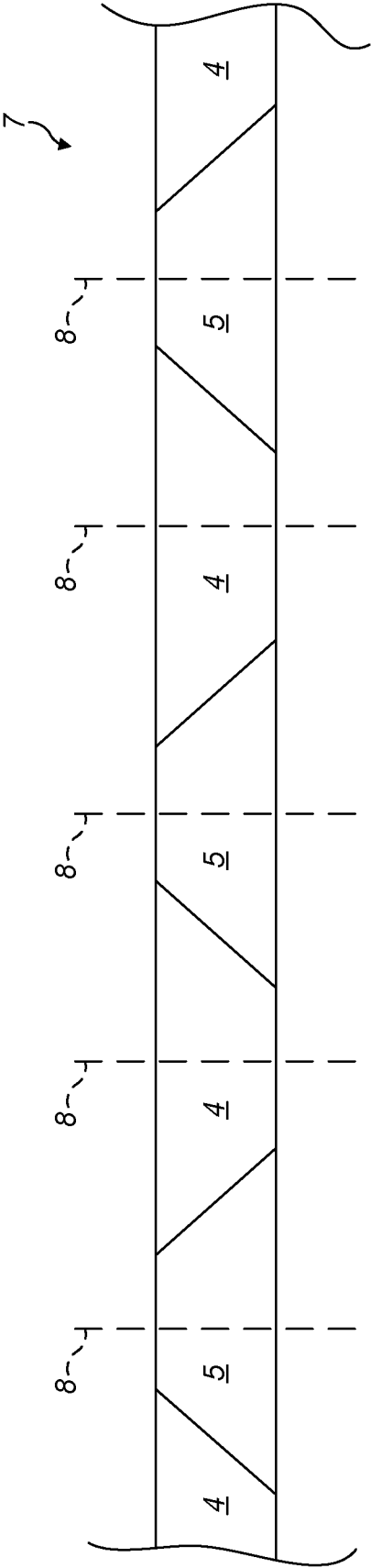


FIG. 2A

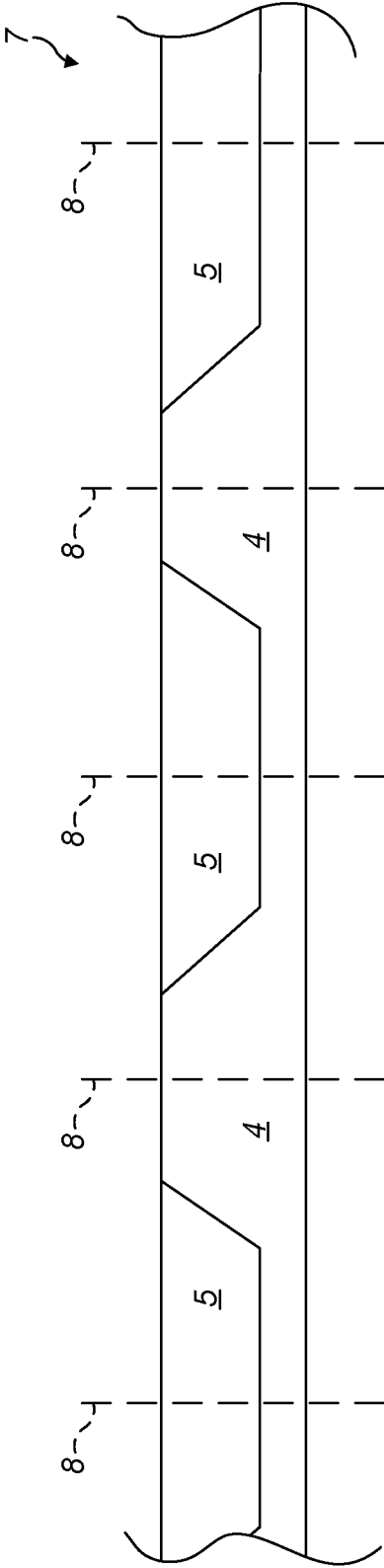
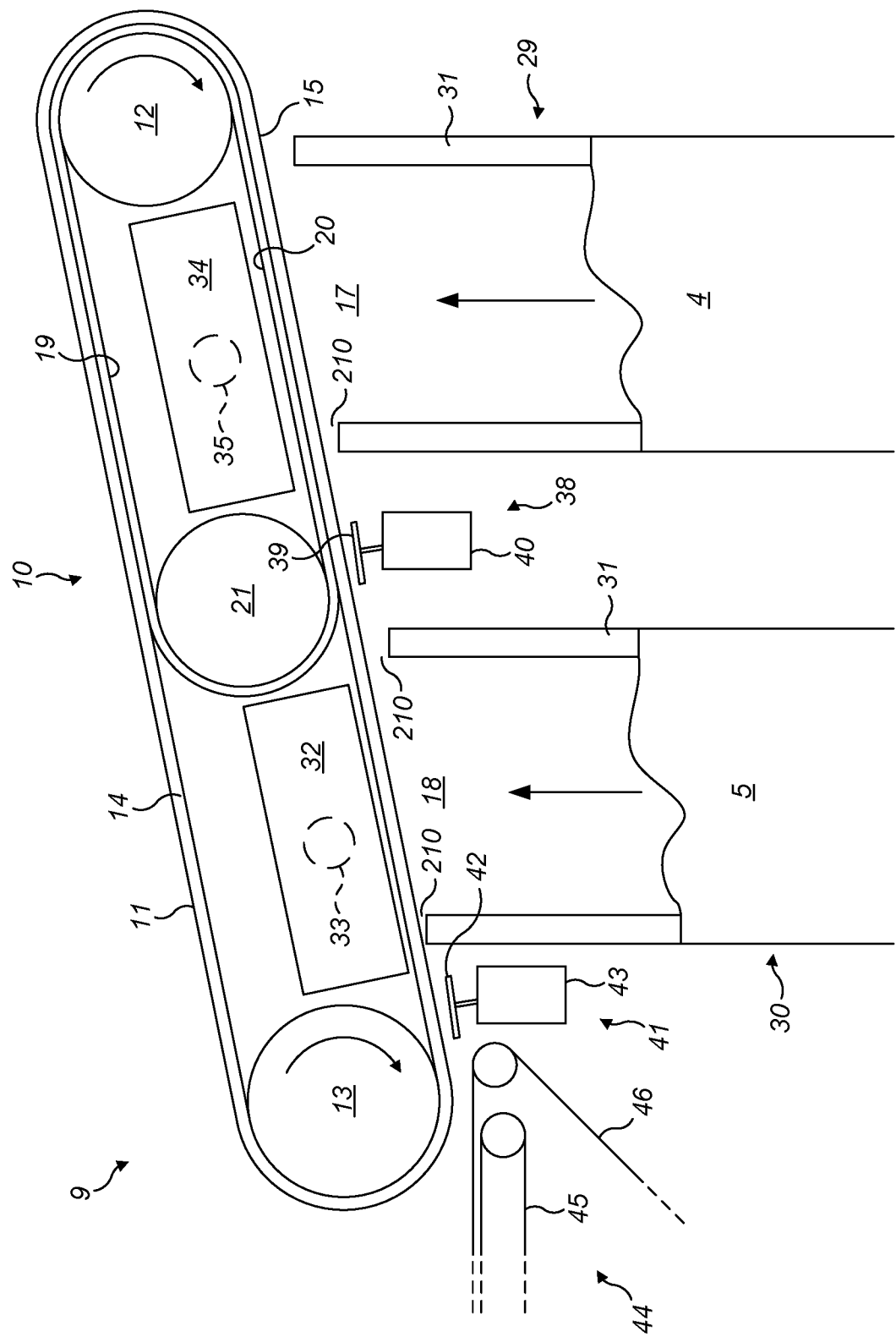


FIG. 2B



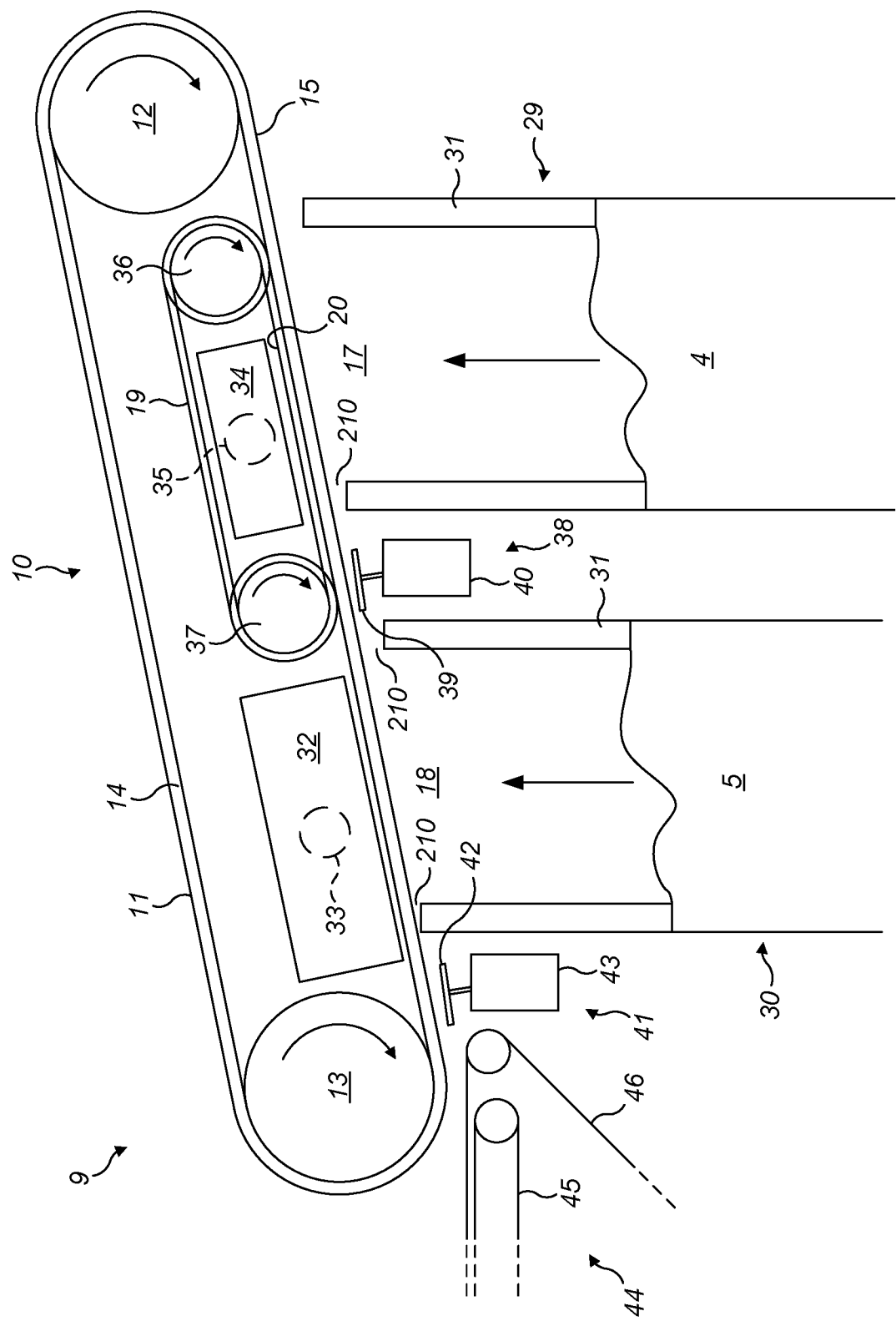


FIG. 4

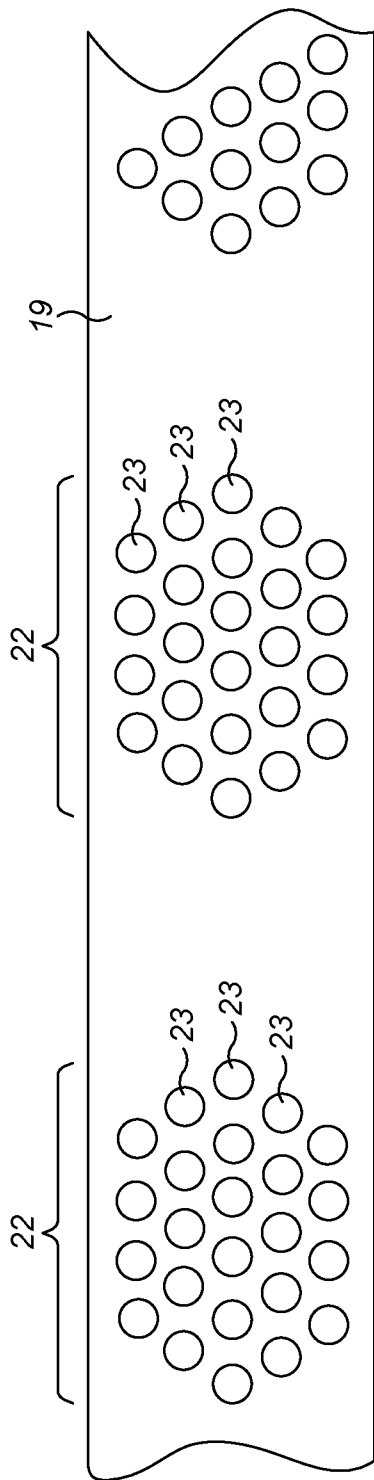


FIG. 5A

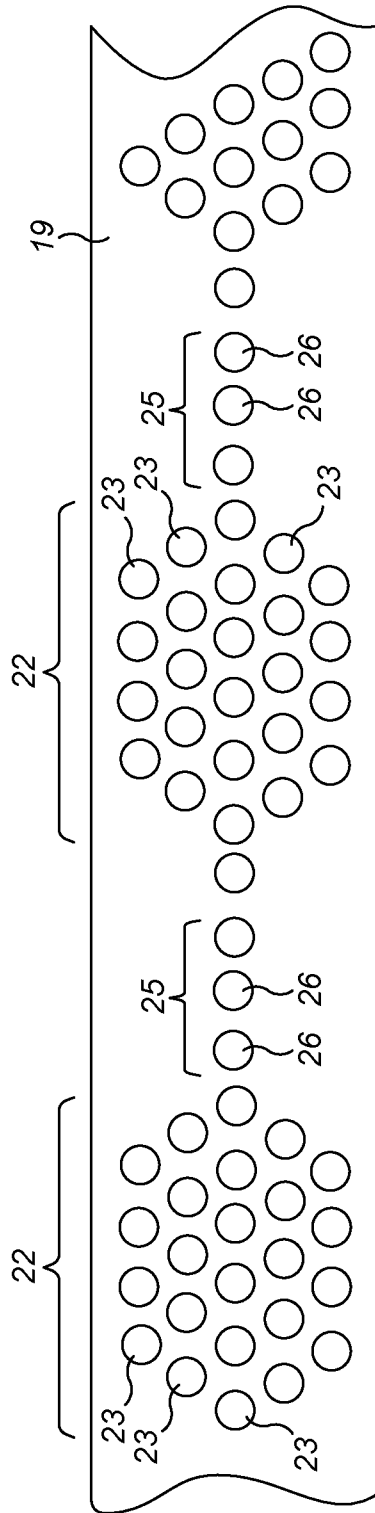


FIG. 5B

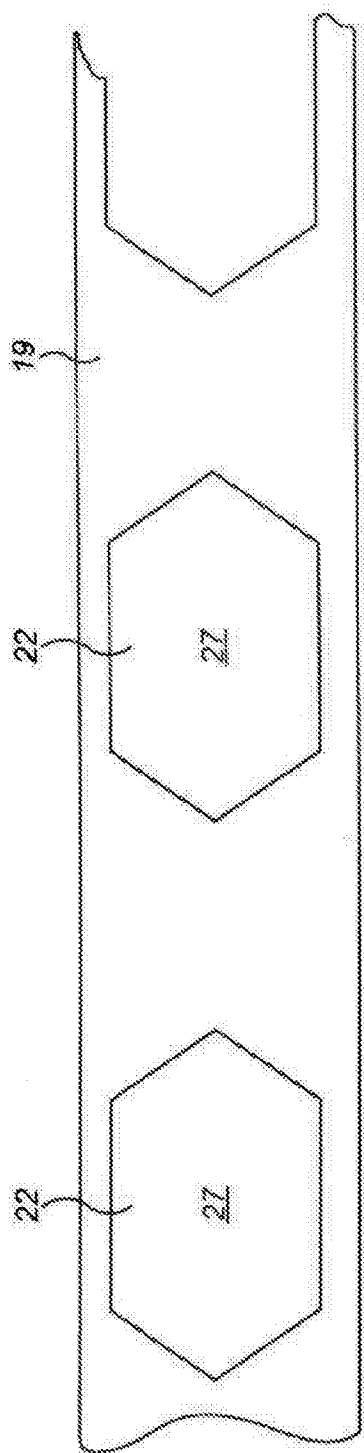


FIG. 6A

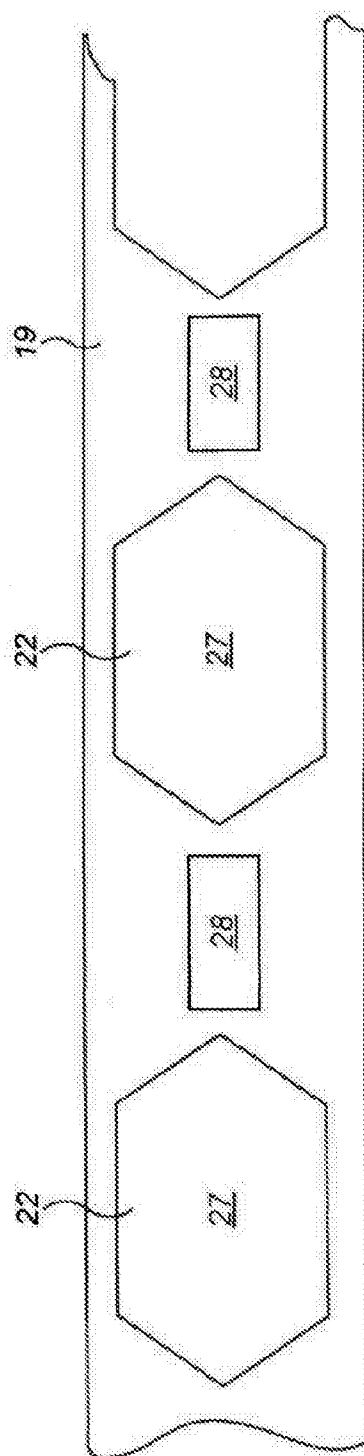


FIG. 6B

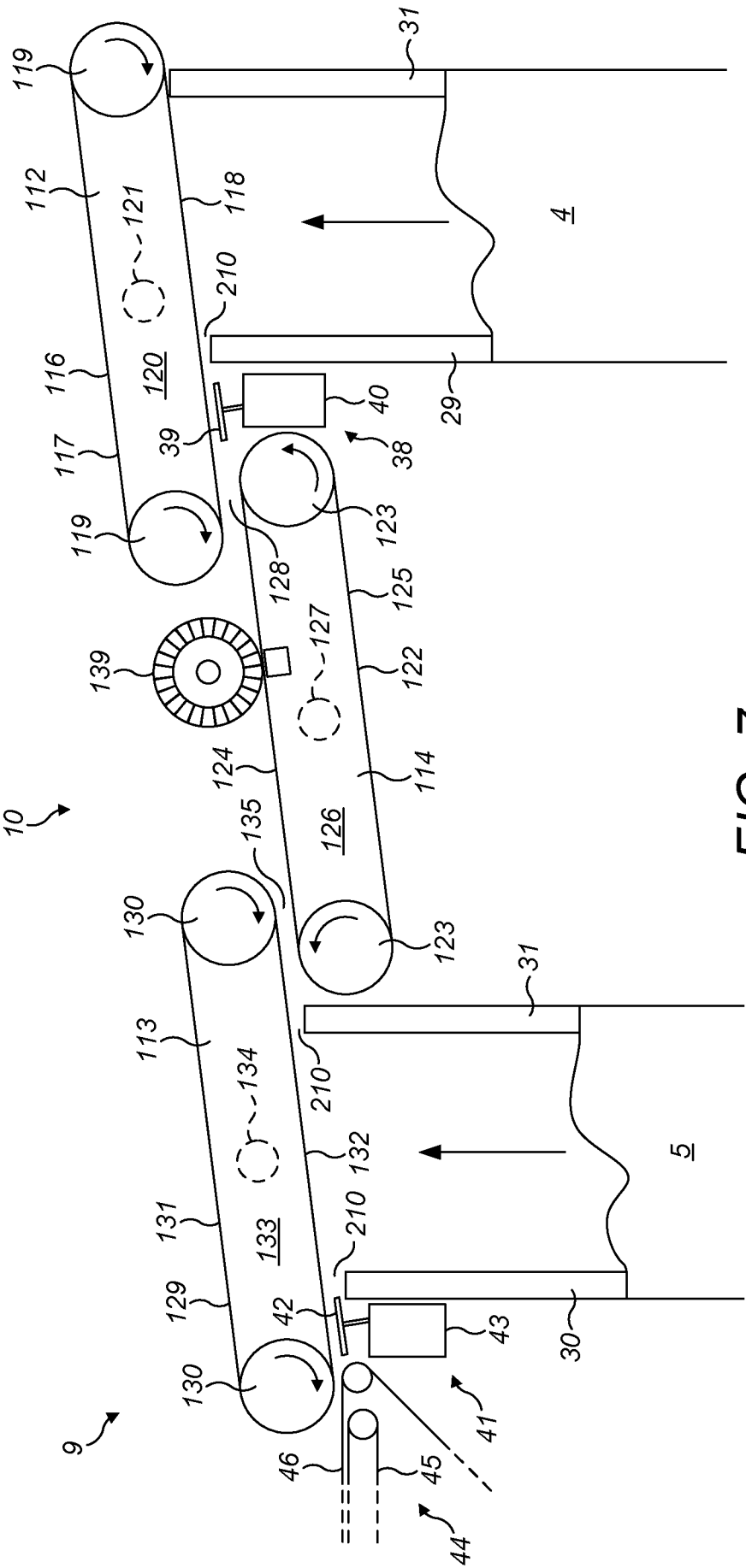


FIG. 7

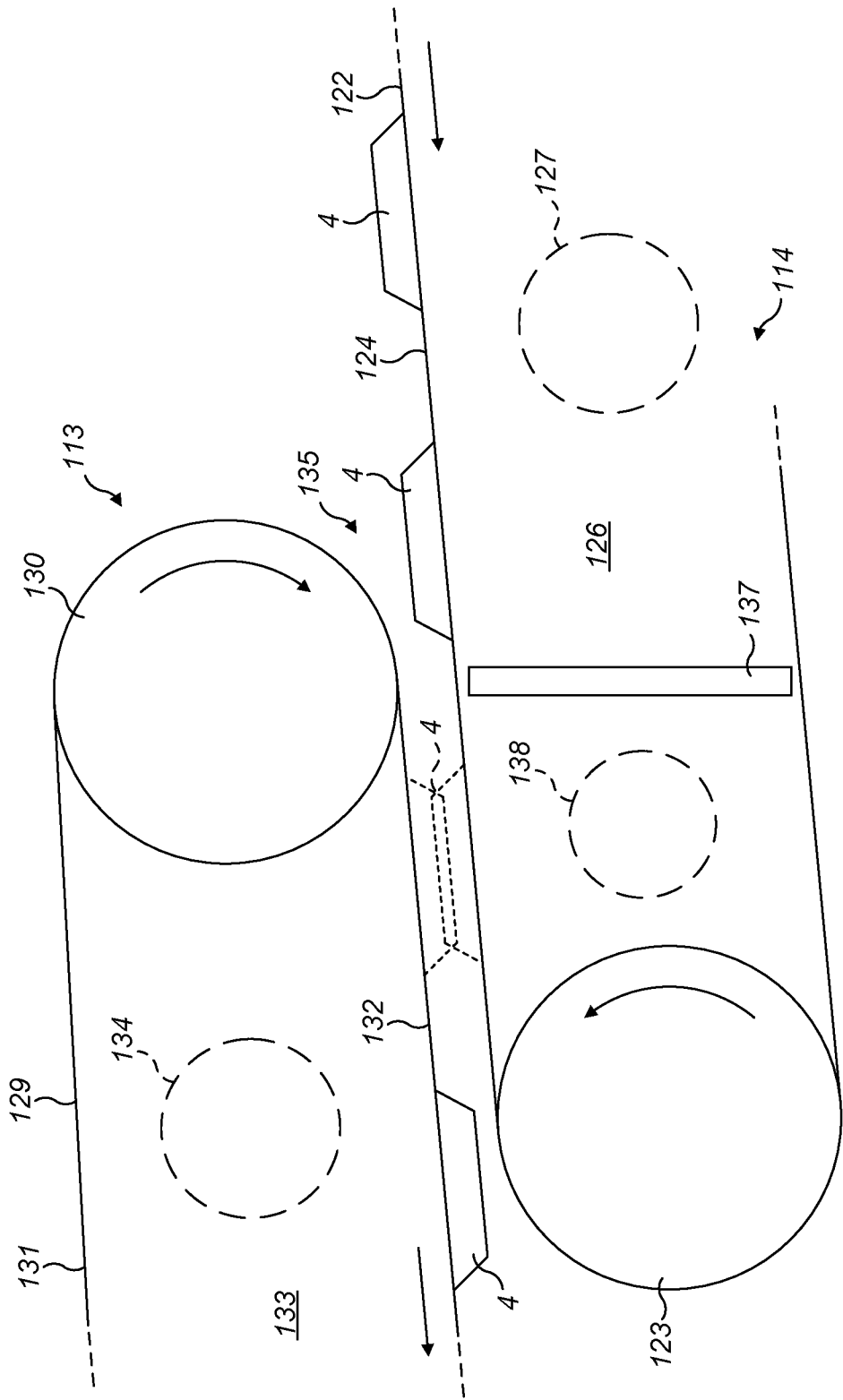


FIG. 8

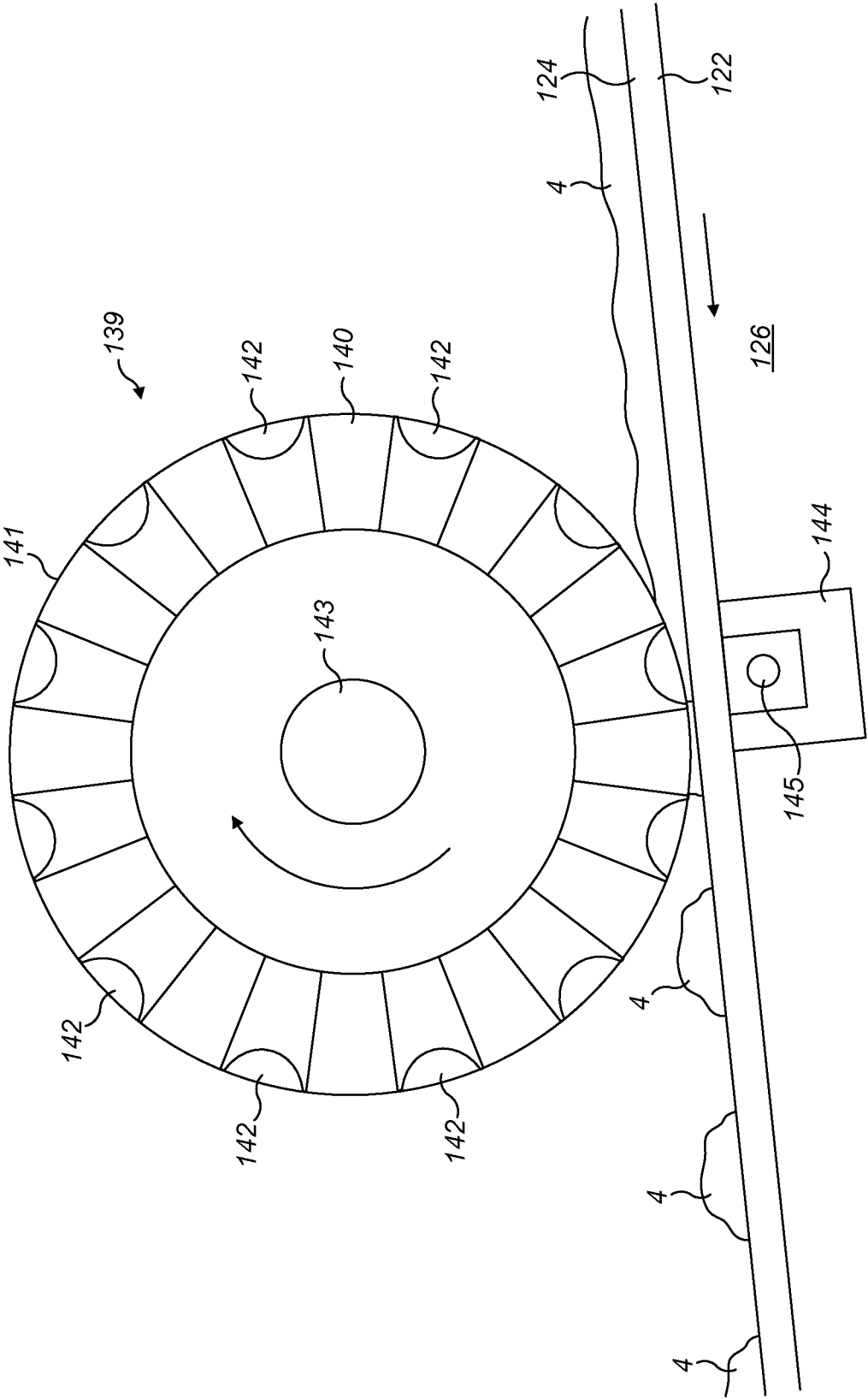


FIG. 9

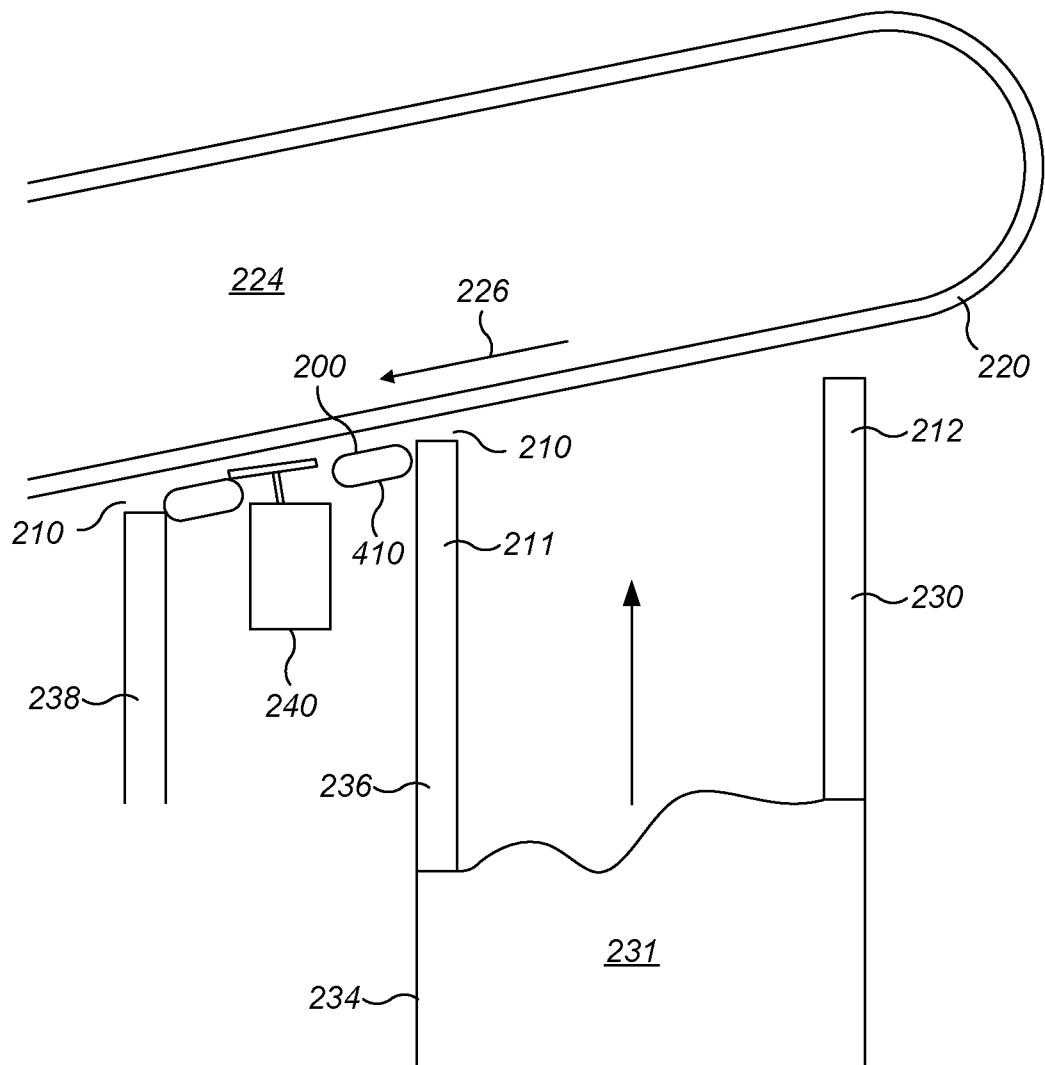


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2020/050377

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24C5/18
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 91/11120 A1 (HRBOTICKY KAREL [CA]) 8 August 1991 (1991-08-08) page 7, line 15 - page 10, line 19; figure 1	1-16
A	----- DE 36 37 724 A1 (GD SPA [IT]) 21 May 1987 (1987-05-21) column 3, line 58 - column 4, line 39; figure 1	1-16
A	----- DE 29 23 201 A1 (MOLINS LTD) 20 December 1979 (1979-12-20) the whole document -----	1,15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

28 April 2020

Date of mailing of the international search report

12/05/2020

Name and mailing address of the ISA/

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Authorized officer

Kock, Søren

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2020/050377

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