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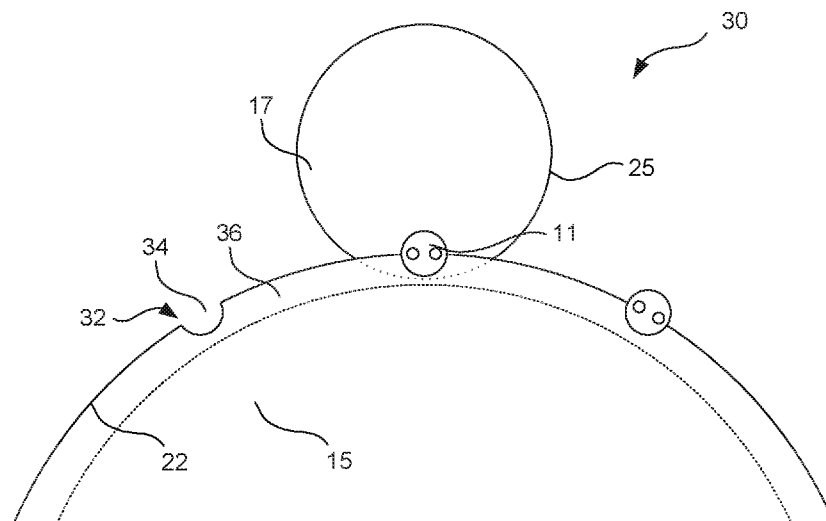


Fig. 4

(57) Abstract: This present invention relates to a rotary cutting apparatus for a tobacco industry product manufacturing apparatus. The rotary cutting apparatus comprises a drum configured to transport components of tobacco industry products as the drum rotates, and a rotary blade comprising a cutting portion arranged to at least partially cut the components on the drum, as the drum rotates. The rotary cutting apparatus is configured such that a ratio of a tangential velocity of the cutting portion of the rotary blade to a tangential velocity of the components is less than approximately 5:1 during use.



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Rotary Cutting Apparatus

Field

This disclosure relates to a rotary cutting apparatus for a tobacco industry product
5 manufacturing apparatus. In particular, but not exclusively, this disclosure relates to a
rotary cutting apparatus for cutting a component of a tobacco industry product.

Background

It is known to transport components for cigarettes on drums that rotate. Such drums
10 have flutes on their outer surface with suction holes that retain the components as the
drum rotates. It is also known to cut those components on the drum as the drum
rotates.

Summary

15 In accordance with some of the embodiments described herein, there is provided a
rotary cutting apparatus for a tobacco industry product manufacturing apparatus, the
rotary cutting apparatus comprising:

a drum configured to transport components of tobacco industry products as the
drum rotates, and

20 a rotary blade comprising a cutting portion arranged to at least partially cut said
components on the drum, as the drum rotates;

wherein the rotary cutting apparatus is configured such that a ratio of a
tangential velocity of the cutting portion of the rotary blade to a tangential velocity of
said components is less than approximately 5:1 during use.

25

In preferred examples, the ratio of the tangential velocity of a cutting portion of the
rotary blade to the tangential velocity of said components is:

less than approximately 2:1; or

less than approximately 1.5:1; or

30 approximately 1:1.

In some embodiments, the rotary blade comprises a peripheral cutting edge, and the
cutting portion may be the peripheral cutting edge of the rotary blade. In other
embodiments, the rotary blade comprises a circular knife having a peripheral cutting
35 edge and opposing side faces, and the cutting portion may be a part of the side faces of
the rotary blade.

The drum may comprise a circumferential groove to receive the rotary blade.

5 In some examples, the rotary blade may be spaced from sides of the circumferential groove. In other examples, the rotary blade may be arranged to cooperate with a side wall of the circumferential groove to shear cut said components during use.

In some examples, the rotary blade may be arranged to cut fully through said components during use.

10

In other examples, the rotary blade may be arranged to cut only partially through said components during use.

15 The rotary cutting apparatus may further comprise an electric motor adapted to rotate the rotary blade relative to the drum during use.

Alternatively, the rotary blade may be free-wheeling and arranged to engage with the drum and/or components on the drum such that the rotary blade is rotated relative to the drum during use.

20

A peripheral surface of the drum may comprise at least one flute extending in a direction parallel to a rotational axis of the drum and configured to receive at least one component of a tobacco industry product.

25 The drum may be configured to transport rod-shaped components of tobacco industry products.

In accordance with some of the embodiments described herein, there is provided a rotary cutting apparatus for a tobacco industry product manufacturing apparatus, the
30 rotary cutting apparatus comprising:

 a drum comprising a peripheral surface configured to receive and transport components of tobacco industry products as the drum rotates, and

 a rotary blade comprising a cutting portion arranged to at least partially cut said components on the drum, as the drum rotates;

wherein the rotary cutting apparatus is configured such that a ratio of a tangential speed of the cutting portion of the rotary blade to a tangential speed of the peripheral surface of the drum is less than approximately 5:1 during use.

- 5 In preferred examples, the ratio of the tangential speed of the cutting portion of the rotary blade to the tangential speed of the peripheral surface of the drum is:
- less than approximately 2:1; or
 - less than approximately 1.5:1; or
 - approximately 1:1.

10

In some embodiments, the rotary blade comprises a peripheral cutting edge, and the cutting portion may be the peripheral cutting edge of the rotary blade. In other embodiments, the rotary blade comprises a circular knife having a peripheral cutting edge and opposing side faces, and the cutting portion may be a part of the side faces of

15 the rotary blade.

The drum may comprise a circumferential groove to receive the rotary blade.

- 20 In some examples, the rotary blade may be spaced from sides of the circumferential groove. In other examples, the rotary blade may be arranged to cooperate with a side wall of the circumferential groove to shear cut said components during use.

- In some examples, the rotary blade may be arranged to cut through said components during use. In other examples, the rotary blade may be arranged to cut only partially
- 25 through said components during use.

- The rotary cutting apparatus may further comprise an electric motor adapted to rotate the rotary blade relative to the drum during use. Alternatively, the rotary blade may be free-wheeling and arranged to engage with the drum and/or components on the drum
- 30 such that the rotary blade is rotated relative to the drum during use.

A peripheral surface of the drum may comprise at least one flute extending in a direction parallel to a rotational axis of the drum and configured to receive at least one component of a tobacco industry product.

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The drum may be configured to transport rod-shaped components of tobacco industry products.

5 In accordance with some of the embodiments described herein, there is provided an apparatus for manufacturing tobacco industry products, which comprises the rotary cutting apparatus described above. The apparatus for manufacturing tobacco industry products may include assembly apparatus that receives cut tobacco industry components from the rotary cutting apparatus and assembles tobacco industry products that include said components and other components.

10

In accordance with some of the embodiments described herein, there is provided a method of manufacturing a tobacco industry product comprising:

transporting a component of a tobacco industry product on a rotating drum;
and

15 at least partially cutting said component on the drum with a rotary blade as the drum rotates;

wherein a ratio of a tangential velocity of a cutting portion of the rotary blade to a tangential velocity of said component is less than approximately 5:1 during use.

20 The method may further comprise transporting said cut components, and combining said cut components with a further component to form a tobacco industry product.

The step of cutting said components may comprise cutting fully through said components. Alternatively, the step of cutting said components may comprise cutting
25 only partially through said components.

The method may comprise driving the rotary blade such that the rotary blade rotates relative to the drum. Alternatively, the rotary blade may be free-wheeling during use.

30 The component of a tobacco industry product may comprise a rod.

The component of a tobacco industry product may comprise a polymer material.

35

Brief Description of the Drawings

So that the invention may be more fully understood embodiments thereof will now be described by way of example only, with reference to the accompanying drawings, in which:

5

Fig. 1 is a schematic side view of a portion of a tobacco industry product manufacturing apparatus including an embodiment of a rotary cutting apparatus;

Fig. 2 is a schematic front view of the rotary cutting apparatus of Fig. 1;

Fig. 3 is a schematic top view of the rotary cutting apparatus of Fig. 1 and Fig. 2;

10

Fig. 4 is a schematic side view of another embodiment of the rotary cutting apparatus;

Fig. 5 is a schematic front view of the rotary cutting apparatus of Fig. 4;

Fig. 6 is a schematic side view of another embodiment of the rotary cutting apparatus; and;

Fig. 7 is a schematic front view of the rotary cutting apparatus of Fig. 6.

15

Detailed Description

Referring to Fig. 1, a part of a tobacco industry product manufacturing apparatus 1 is shown. The part of the tobacco industry product manufacturing apparatus 1 comprises a rotary cutting apparatus 10 which is configured to divide a rod 11 of material into cut
20 rods 12. The cut rods 12 may be individual components of a tobacco industry product, or the cut rods 12 may be two or more components of tobacco industry products joined together, which can be cut again during manufacture of the tobacco industry products.

In one example, the rods 11 are made of a polymer material. In other examples, the rods
25 11 may be made of a paper-based material, cellulose acetate, ceramic, or other material. The material of the rods 11 may have a low melting point, or they may be vulnerable to heat damage, or they may be friable and therefore vulnerable to damage during a cutting operation.

30 Optionally, the rods 11 comprise at least one channel 13 extending through the rod 11 in a longitudinal direction. The rods 11 are cut into individual components of a tobacco industry product, for example the cut rods 12 may be a component for the filter of a cigarette or other tobacco industry product.

35 The manufacturing apparatus 1 comprises a feeding device 14, a drum 15, a transfer drum 16, and a rotary blade 17. The drum 15 and rotary blade 17 form the rotary

cutting apparatus 10. The feeding device 14 is configured to feed rods 11 onto the drum 15. In the present embodiment, as shown in Fig. 1, the feeding device 14 is a hopper 18. The hopper 18 comprises inclined side walls 19 configured to funnel the rods 11 into a single line so that they can be delivered through a delivery channel 20 onto the drum 15. The feeding device 14 delivers the rods 11 onto the drum 15 such that their longitudinal axis is transverse to the direction of travel. In an alternative embodiment, the feeding device 14 which feeds the rods 11 onto the drum 15 may comprise another drum (not shown).

10 The drum 15 is cylindrical and rotates about its longitudinal axis A. In the view of Fig. 1, the drum 15 rotates clockwise. The drum 15 receives the rods 11 from the feeding device 14 on its circumferential surface 22. The drum 15 is configured to transport the rods 11 in a direction transverse to their longitudinal axis. The drum 15 is configured to transport the rods 11 past the rotary blade 17 and to the transfer drum 16, which receives the cut rods 12 and transfers them into the remainder of the tobacco industry product manufacturing apparatus 1. Alternatively, the transfer drum 16 may output the cut rods 12 into a container (not shown). In another embodiment, the transfer drum 16 may be omitted.

20 The rods 11 are held on the circumferential surface 22 of the drum 15 by suction. A pump (not shown) is connected to at least one aperture (not shown) in the circumferential surface 22 of the drum 15. The apertures may be arranged in lines extending along the circumferential surface 22, parallel to the longitudinal axis of the drum 15, to form a line of apertures (not shown). In this way, the rods 11 and cut rods 12 are held on the drum 15 by suction provided to the apertures. Multiple lines of apertures (not shown) may be located about the circumference of the drum 15 so that the drum 15 can transport more than one rod 11 at a time.

30 The pump (not shown) sucks air through the apertures so that the rods 11 and cut rods 12 are held on the circumferential surface 22 by suction. The pump may only act upon the apertures (not shown) in the part of rotation between the feeding device 14 and the transfer drum 16.

35 In the embodiment of Fig. 1, the drum 15 rotates about its longitudinal axis which extends through its centre A. The rotary blade 17 also rotates about its centre B. The

rotary blade 17 rotates in the opposite direction to the drum 15. That is, in the view of Fig. 1, the rotary blade 17 rotates anti-clockwise.

5 In the present embodiment, the rotary blade 17 is a circular knife. The rotary blade 17 comprises a cutting edge 25 that engages with and cuts through the rods 11 as they are carried by the drum 15. During cutting, a cutting portion of the rotary blade 17 contacts the rods 11, in particular the ends of the cut rods 12.

10 The drum 15 and the rotary blade 17 are arranged such that the ratio of the tangential velocity of a cutting portion of the rotary blade 17 to the tangential velocity of the rods 11 is less than approximately 5:1. That is, the rotational speed of the rotary blade 17 and the rotational speed of the drum 15 are arranged so that the rods 11 and the cutting portion of the rotary blade 17 are moving at a similar, or the same, tangential velocity.

15 In this way, rubbing between the sides 26 of the rotary blade 17 in the cutting portion and the ends of the cut rods 12 is reduced. This reduces friction and protects the cut rods 12 against damage that may be caused by heat. Comparatively, if the tangential speed of the cutting portion of the rotary blade 17 were significantly faster than the tangential speed of the rods 11, then friction between the rotary blade 17 and the rods 11
20 may generate heat that can damage the cut rods 12. Also, rubbing between the rotary blade 17 and the rods 11 may damage the cut rods 12 if they are made of a delicate material, for example paper or a friable material. In addition, the amount of dust and debris (e.g. swarf) produced during the cutting is reduced.

25 Fig. 2 shows a front view cross-section of the drum 15 and rotary blade 17 at the point where the rods 11 are cut. The cutting edge 25 of the rotary blade 17 is received in a groove 36 formed in the circumferential surface 22 of the drum 15 so that there is no direct contact between the rotary blade 17 and the drum 15. Such contact may cause blunting of the cutting edge 25 and/or additional heat to be generated between the
30 drum 15 and the rotary blade 17, which may damage the rods 11.

Fig. 3 shows the rotary cutting apparatus of Fig. 2 from a top view, in particular Fig. 3 shows the rotary blade 17, drum 15, groove 36 in the drum 15 and a rod and two cut rods 12 formed from the rod 11.

Cutting is performed by the cutting edge 25 of the rotary blade 17 as the rotary blade 17 and the drum 15 carrying the rods 11 rotate.

As the rods 11 are cut the side faces 26 of the rotary blade 17 in the region of the cut rods 12 rub against the newly formed ends 27 of the cut rods 12. Friction in this area can generate heat and, depending on the material of the rods 11, may melt, burn, or otherwise damage the ends 27 of the cut rods 12. Alternatively, if the rods 11 are made of a frangible material then the friction may cause parts of the ends 27 of the cut rods 12 to be dislodged.

10

In Fig. 2 and Fig. 3 the cutting edge 25 of the rotary blade 17 is a flat V. That is, the tip of the rotary cutter 17 is a symmetrical triangle. The cutting edge 25 cuts through the rods 11 as the 15 drum and rotary blade 17 rotate. However, in an alternative embodiment, the cutting edge 25 may be, for example, but not limited to, an asymmetrical flat V, a compound bevel, semi convex, a chisel, or a chisel with a back bevel.

In an embodiment of the invention, shown in Fig. 1 to Fig. 3, the rotary blade 17 rotates such that the ratio of the tangential velocity of the cutting portion of the rotary blade 17 to the tangential velocity of the rods 11 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

An advantage of this arrangement is that the movement of the rotary blade 17 relative to the rods 11 is reduced, if not eliminated. Moreover, the relative movement between the side faces 26 of the rotary blade 17 and the newly formed ends 27 of the cut rods 12, shown in Fig. 2 and Fig. 3, is reduced.

In another example, the rotary blade 17 rotates such that the ratio of the tangential speed of the cutting edge 25 of the rotary blade 17 to the tangential speed of the peripheral surface 22 of the drum 15 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

In this way, given that the rods 11 are transported on the circumferential surface 22 of the drum 15, and that the cutting edge 25 is proximate to the circumferential surface

22, in effect the ratio of the tangential velocity of the cutting portion of the rotary blade 17 to the tangential velocity of the rods 11 is approximately the same, i.e. it is also less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

5

In the embodiment shown in Fig. 1 to Fig. 3, the rotary blade 17 is driven by an electric motor (not shown), for example a servomotor. The electric motor can be controlled to rotate the rotary blade 17 at the appropriate speed. An advantage of driving the rotary blade 17 using a servomotor is that the rotational speed of the rotary blade 17 can be controlled precisely. Moreover, the rotations of the drum 15 and the rotary blade 17 can be either mechanically or electronically geared to each other, such that the ratio of rotational speeds of the drum 15 and rotary blade 17 is fixed.

15 In an alternative embodiment, the drum 15 and rotary blade 17 may be driven by the same electric motor/actuator, by providing gears or pulleys between the drum 15 and the rotary blade 17 that fix their rotations together.

20 In other embodiments, the rotary blade 17 may not be independently driven, but may rotate due to the interaction with the rods 11. Therefore, the rotary blade 17 is rotated at the same speed as the rods 11 due to the contact between the two. An advantage of such a free-wheeling rotary blade 17 is that the manufacturing apparatus 10 is simplified.

25 Referring now to Fig. 4 and Fig. 5, in a further embodiment of a rotary cutting apparatus 30 for a tobacco industry product manufacturing apparatus is shown. The rotary cutting apparatus 30 is generally the same as the previous embodiments of the rotary cutting apparatus 10 described above and so a detailed description will be omitted herein. Furthermore, features and component of the rotary cutting apparatus 30 will retain the same terminology and reference numerals.

35 Fig. 4 shows an enlarged cross-sectional side view of this embodiment of the rotary cutting apparatus 30. In the rotary cutting apparatus 30, a circumferential surface 22 of a drum 15 comprises a flute 32 extending in a direction parallel to the longitudinal axis of the drum 15 and configured to receive and carry a rod 11. The flute 32 is

configured to hold the rod 11 in position on the circumferential surface 22 of the drum 15.

The flute 32 is a channel 34 formed in the circumferential surface 22 of the drum 15.

- 5 The channel 34 has a partly circular cross-section, for example an approximately semi-circular cross-section, which substantially matches the circumference of the rod 11. Apertures (not shown) in the drum 15 extend to the innermost part of the channel 34 and suction is provided to these apertures to hold the rods 11 on the drum 15 for at least a part of the rotation of the drum 15.

10

The flute 32 extends along the circumferential surface 22 of the drum 15 in a direction parallel to the longitudinal axis of the drum 15, the axis of rotation. The drum 15 further comprises a groove 36 in the circumferential surface 22. The groove 36 is indicated by a dotted line in Fig. 4 and is the same as in the example of Fig. 2 and Fig. 3.

- 15 The groove 36 extends in the circumferential direction around the whole of the drum 15. The groove 36 is configured to receive the rotary blade 17 in order for a cutting edge 25 to be able to completely cut through the rod 11.

- Fig. 5 shows an enlarged cross-sectional front view of the top of the drum 15 and
20 bottom of the rotary blade 17. Fig. 5 shows the circumferential groove 36 extending radially into the drum 15 from the circumferential surface 22. The circumferential groove 36 comprises a bottom surface 37 and side walls 38. The bottom surface 37 is parallel to the circumferential surface 22 and is either aligned with, or disposed further towards the axis of the drum, than the bottom of the flute 32 so that the rotary blade 17
25 can pass all the way through the rod 11. The side walls 38 of the circumferential groove 36 extend perpendicularly to the circumferential surface 22.

- The side faces 26 of the rotary blade 17 are spaced from the side walls 38 of the groove 36 so that they do not contact each other during operation. This would prevent heat
30 being generated by them rubbing together, and thus prevents heat damaging the rods 11.

- As in the previous embodiments, the rotary blade 17 may be free-wheeling or may be driven by a servo motor. The rotary blade 17 rotates such that the ratio of the tangential
35 velocity of the cutting portion of the rotary blade 17 to the tangential velocity of the rods

11 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

5 An advantage of this arrangement is that the movement of the rotary blade 17 relative to the rods 11 is reduced, if not eliminated. Moreover, the relative movement between the side faces 26 of the rotary blade 17 and the newly formed ends 27 of the cut rods 12, shown in Fig. 2 and Fig. 3, is reduced.

10 In another example, the rotary blade 17 rotates such that the ratio of the tangential speed of the cutting edge 25 of the rotary blade 17 to the tangential speed of the peripheral surface 22 of the drum 15 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

15 In this way, given that the rods 11 are transported on the circumferential surface 22 of the drum 15, and that the cutting edge 25 is proximate to the circumferential surface 22, in effect the ratio of the tangential velocity of the cutting portion of the rotary blade 17 to the tangential velocity of the rods 11 is the approximately same, i.e. it is also less than approximately 5:1, preferably less than approximately 2:1, more preferably less
20 than approximately 1.5:1, and most preferably approximately 1:1.

Referring now to Fig. 6 and Fig. 7, a further embodiment of a portion of a rotary cutting apparatus 40 for a tobacco industry manufacturing apparatus is shown. The rotary cutting apparatus 40 is generally the same as the previous embodiments of the rotary
25 cutting apparatus 10, 30 described above and so a detailed description will be omitted herein. Furthermore, features and components of the rotary cutting apparatus 40 will retain the same terminology and reference numerals.

30 Fig. 6 shows an enlarged cross-sectional side view of this embodiment of the rotary cutting apparatus 40. In the rotary cutting apparatus 40, a circumferential surface 22 of a drum 15 comprises a flute 32 as described in reference to Fig. 4 and Fig. 5.

35 In this embodiment, the drum 15 comprises a groove 36, indicated by the dotted line in Fig. 6, in the circumferential surface 22 which extends in the circumferential direction around the whole of the drum 15. The groove 36 is configured to receive the rotary blade 17 in order for a cutting edge 25 to cut through the rod 11. In the present

embodiment, the groove 36 extends inwardly in a radial direction further than the flute 42. That is, a bottom surface 37 of the groove 36 is closer to the centre A of the drum 15 than the bottom of the flute 32 is. Furthermore, the rotary blade 17 is positioned such that the cutting edge 25 extends beyond the bottom of the rod 11.

5

Fig. 7 shows an enlarged cross-sectional front view of the top of the drum 15 and the bottom of the rotary cutter 17. Fig. 7 shows the circumferential groove 36 extending radially into the drum 15 from the circumferential surface 22. The circumferential groove 36 comprises the bottom surface 37 and side walls 38. The bottom surface 37
10 extends parallel to the circumferential surface 22 and is located at a smaller radial distance from the centre A of the drum 15 than the bottom of the flute 32. The side walls 38 of the groove 36 extend perpendicularly to the circumferential surface 22.

In the present embodiment, the cutting edge 25 of the rotary blade 17 is spaced from
15 the bottom surface 37 of the groove 36. In this embodiment, the rotary blade 17 is configured to perform a “shear cut” in which a second cutting edge 41 is formed by the side wall 38 of the groove 36, which is configured to cooperate with the rotary blade 17 as the drum 15 rotates to shear cut the rods 11. As shown in Fig. 7, the cutting edge 25 of the rotary blade 17 is formed by a chisel edge. However, it will be understood that
20 the cutting edge 25 of the rotary blade 17 may be alternatively formed as discussed above.

The rotary blade 17 may be driven by a servomotor, or it may be free-wheeling.

25 The rotary blade 17 rotates such that the ratio of the tangential velocity of the cutting portion of the rotary blade 17 to the tangential velocity of the rods 11 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

30 In another example, the rotary blade 17 rotates such that the ratio of the tangential speed of the cutting edge 25 of the rotary blade 17 to the tangential speed of the peripheral surface 22 of the drum 15 is less than approximately 5:1, preferably less than approximately 2:1, more preferably less than approximately 1.5:1, and most preferably approximately 1:1.

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These arrangements will minimise or eliminate rubbing between the rotary blade 17 and the ends of the cut rods 12. Moreover, these arrangements will minimise or eliminate rubbing between the rotary blade 17 and the side wall 38 of the groove 36.

5 In alternative embodiments similar to any of the embodiments described with reference to Fig. 1 to Fig. 7, the cutting edge 25 of the rotary blade 17 may be arranged such that the rod 11 is only partially cut, i.e. the rotary blade 17 does not cut completely through the rods 11. In this example, the apparatus may further include a roll hand that causes the rods 11 to be rolled over the circumferential surface of the drum 15 whilst
10 being cut, so that the rods 11 are cut evenly from each direction.

It will be understood that an alternative embodiment of the invention may comprise more than one rotary blade 17 arranged adjacent to each other, to cut the rod 11 into at least three cut rods 12.

15 It will also be understood that the rotary cutting apparatus 10 may be used to cut components that are not rods 11. The rotary cutting apparatus 10 may be used to cut components of tobacco industry products that have other, non-rod-like shapes. For example, the rotary cutting apparatus 10 may be used to cut sheet materials or webs, such as paper wrappers or ribbons, or it may be used to cut non-elongate components.
20

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
25 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
30 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 example, the tobacco industry product manufacturing apparatus described
35 previously, which includes the rotary cutting apparatus 10, 30, 40, is used to make a

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

5 In another example, the apparatus is used to make a tobacco industry product that is a non-combustible smoking article.

10 In another example, the apparatus is used to make tobacco industry product that is a heating device which releases compounds by heating, but not burning, a substrate material. The 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. The apparatus may alternatively be used to make a consumable for a heating device.

15 In another embodiment the apparatus is used to make a tobacco industry product that is a hybrid system to generate aerosol by heating, but not burning, a combination of substrate materials. The substrate materials may comprise for example solid, liquid or gel 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
20 nicotine. In one embodiment the hybrid system comprises a liquid or gel substrate and tobacco.

25 In order to address various issues and advance the art, the entirety of this disclosure shows by way of illustration various embodiments in which the claims invention(s) may be practiced and provide for a superior rotary cutting apparatus. The advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and teach the claimed features. It is to be understood that advantages, embodiments, examples, functions, features, structures and/or other aspects of the disclosure are not
30 to be considered limitations on the disclosure 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 and/or spirit of the disclosure. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. In addition, the disclosure includes other inventions not
35 presently claimed, but which may be claimed in future.

Claims

1. A rotary cutting apparatus for a tobacco industry product manufacturing apparatus, the rotary cutting apparatus comprising:
 - 5 a drum configured to transport components of tobacco industry products as the drum rotates, and
 - a rotary blade comprising a cutting portion arranged to at least partially cut said components on the drum, as the drum rotates;
 - wherein the rotary cutting apparatus is configured such that a ratio of a
 - 10 tangential velocity of the cutting portion of the rotary blade to a tangential velocity of said components is less than approximately 5:1 during use.
2. The rotary cutting apparatus according to claim 1, wherein the ratio of the tangential velocity of a cutting portion of the rotary blade to the tangential velocity of
15 said components is:
 - less than approximately 2:1; or
 - less than approximately 1.5:1; or
 - approximately 1:1.
- 20 3. The rotary cutting apparatus of claim 1 or claim 2, wherein the rotary blade comprises a peripheral cutting edge, and wherein the cutting portion is the peripheral cutting edge of the rotary blade.
4. The rotary cutting apparatus of claim 1 or claim 2, wherein the rotary blade
25 comprises a circular knife having a peripheral cutting edge and opposing side faces, and wherein the cutting portion is a part of the side faces of the rotary blade.
5. The rotary cutting apparatus according to any preceding claim, wherein the drum comprises a circumferential groove to receive the rotary blade.
30
6. The rotary cutting apparatus according to claim 5, wherein the rotary blade is spaced from sides of the circumferential groove.
7. The rotary cutting apparatus according to claim 5, wherein the rotary blade is
35 arranged to cooperate with a side wall of the circumferential groove to shear cut said components during use.

8. The rotary cutting apparatus according to any preceding claim, wherein the rotary blade is arranged to cut fully through said components during use.
- 5 9. The rotary cutting apparatus according to any of claims 1 to 7, wherein the rotary blade is arranged to cut only partially through said components during use.
10. The rotary cutting apparatus according to any preceding claim, further comprising an electric motor adapted to rotate the rotary blade relative to the drum
10 during use.
11. The rotary cutting apparatus according to any of claims 1 to 9, wherein the rotary blade is free-wheeling and arranged to engage with the drum and/or components on the drum such that the rotary blade is rotated relative to the drum
15 during use.
12. The rotary cutting apparatus according to any preceding claim, wherein a peripheral surface of the drum comprises at least one flute extending in a direction parallel to a rotational axis of the drum and configured to receive at least one
20 component of a tobacco industry product.
13. The rotary cutting apparatus of any preceding claim, wherein the drum is configured to transport rod-shaped components of tobacco industry products.
- 25 14. A rotary cutting apparatus for a tobacco industry product manufacturing apparatus, the rotary cutting apparatus comprising:
a drum comprising a peripheral surface configured to receive and transport components of tobacco industry products as the drum rotates, and
a rotary blade comprising a cutting portion arranged to at least partially cut said
30 components on the drum, as the drum rotates;
wherein the rotary cutting apparatus is configured such that a ratio of a tangential speed of the cutting portion of the rotary blade to a tangential speed of the peripheral surface of the drum is less than approximately 5:1 during use.
- 35 15. Apparatus for manufacturing tobacco industry products, comprising the rotary cutting apparatus of any of claims 1 to 14.

16. A method of manufacturing a tobacco industry product comprising:
transporting a component of a tobacco industry product on a rotating drum;
and
5 at least partially cutting said component on the drum with a rotary blade as the
drum rotates;
wherein a ratio of a tangential velocity of a cutting portion of the rotary blade to
a tangential velocity of said component is less than approximately 5:1 during use.
- 10 17. The method of claim 16, further comprising transporting said cut components,
and combining said cut components with a further component to form a tobacco
industry product.
18. The method of claim 16 or claim 17, wherein the step of cutting said components
15 comprises cutting fully through said components.
19. The method of claim 16 or claim 17, wherein the step of cutting said components
comprises cutting only partially through said components.
- 20 20. The method of any of claims 16 to 19, further comprising driving the rotary
blade such that the rotary blade rotates relative to the drum.
21. The method of any of claims 16 to 19, wherein the rotary blade is free-wheeling
during use.
25
22. The method of any of claims 16 to 21, wherein said component of a tobacco
industry product comprises a rod.
23. The method of any of claims 16 to 22, wherein said component of a tobacco
30 industry product comprises a polymer material.

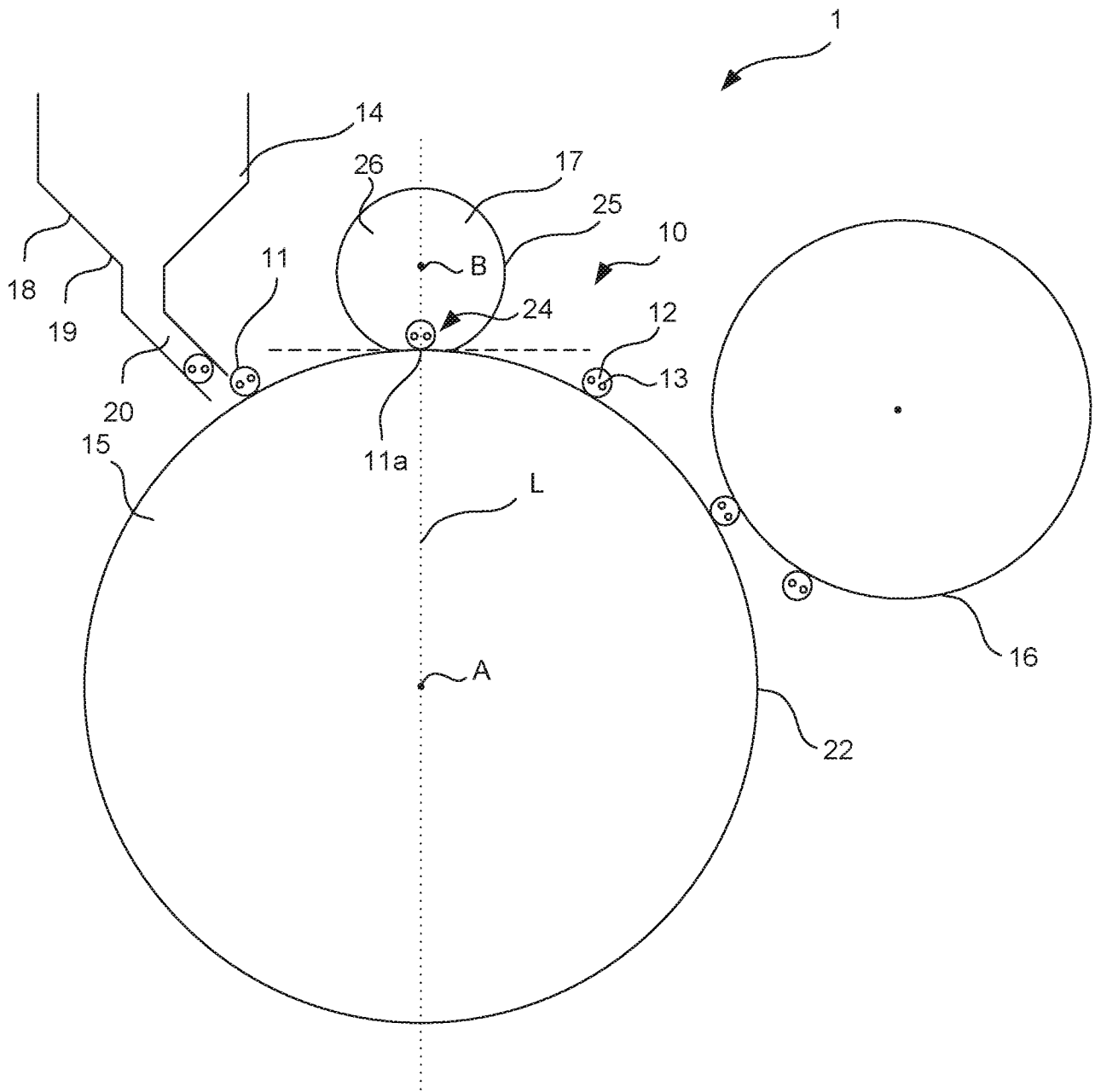
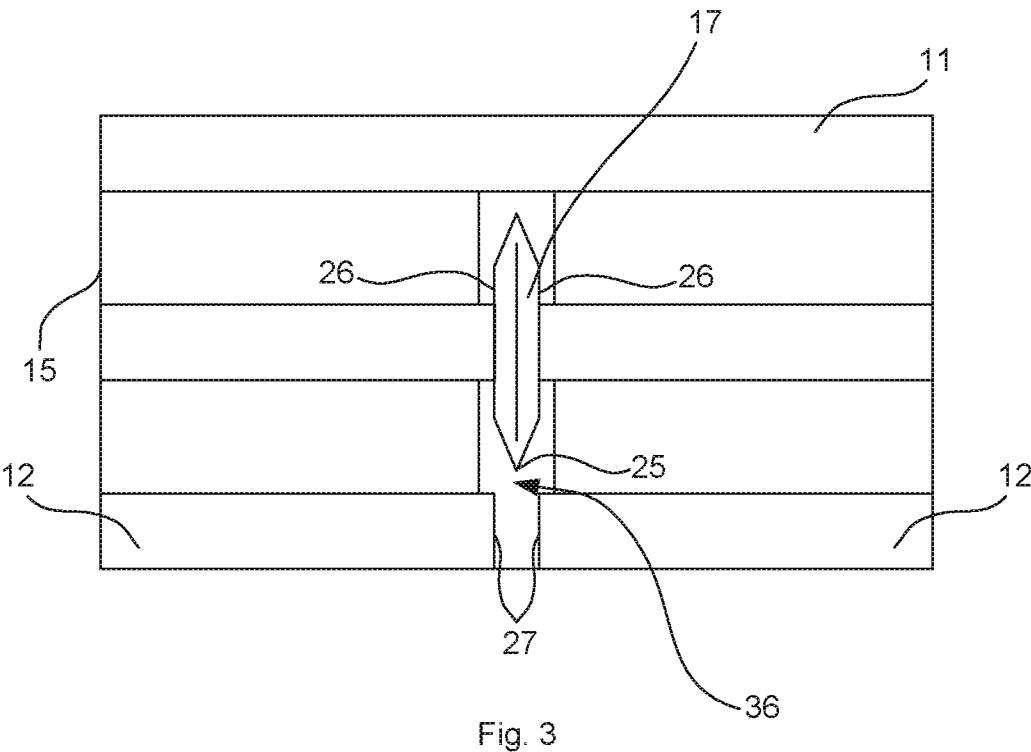
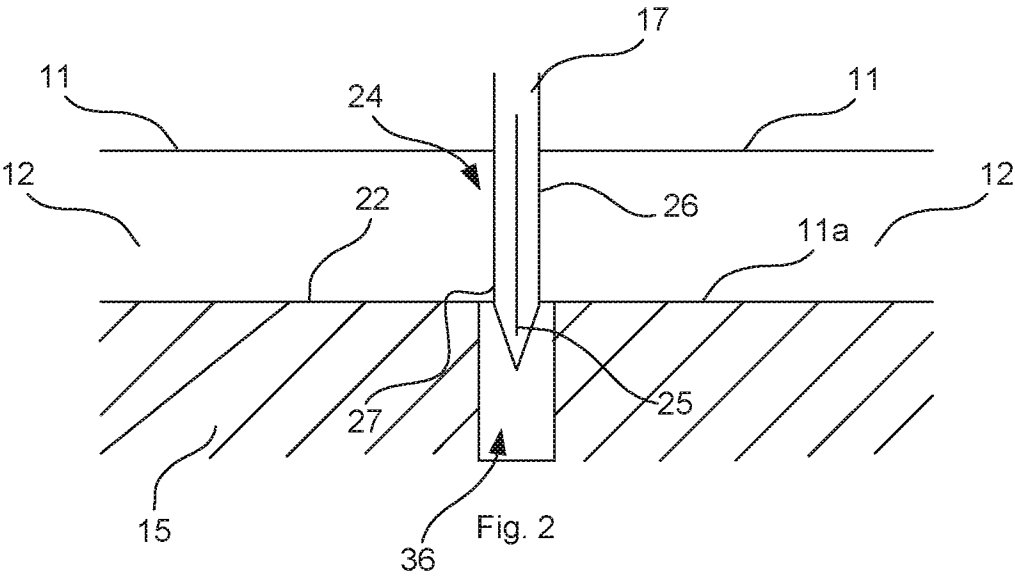


Fig. 1



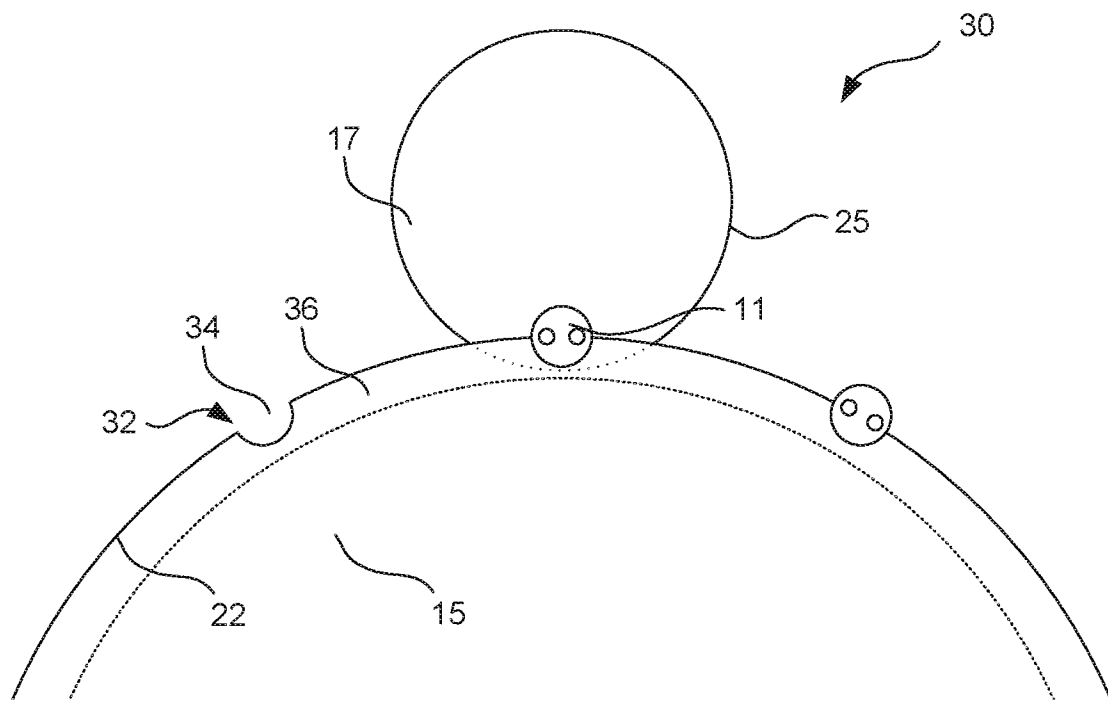


Fig. 4

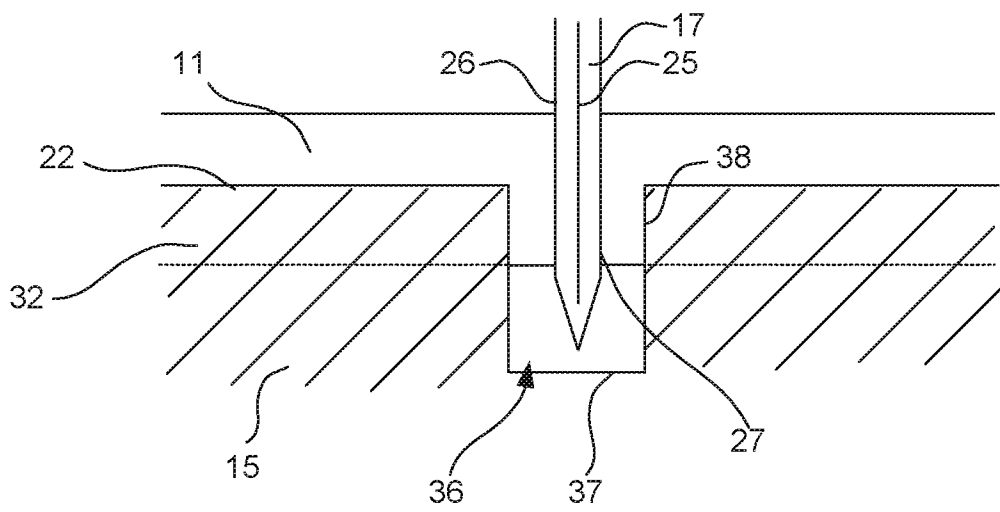


Fig. 5

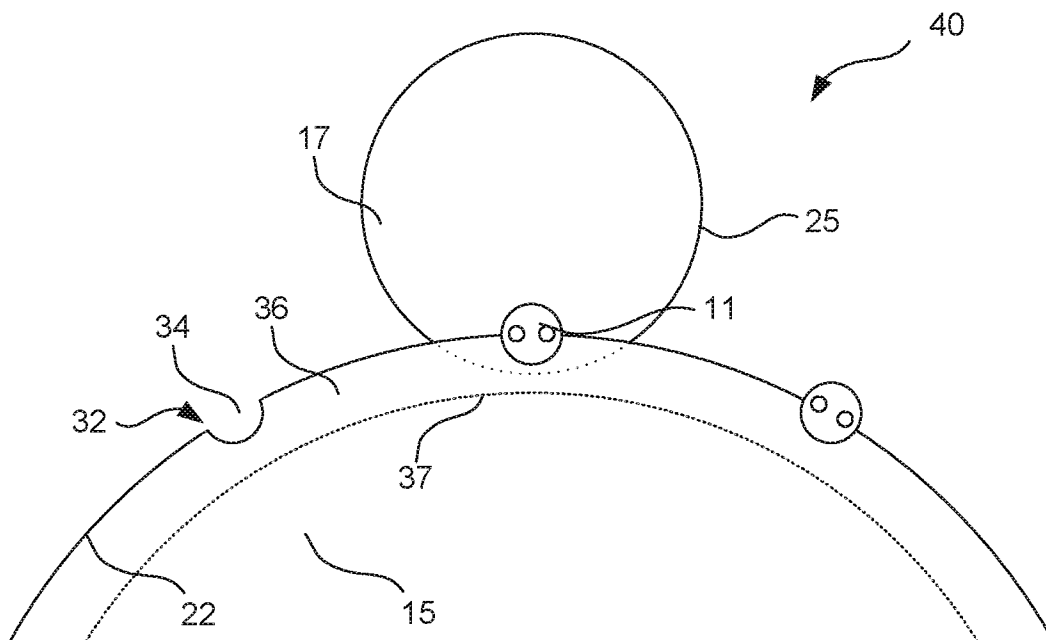


Fig. 6

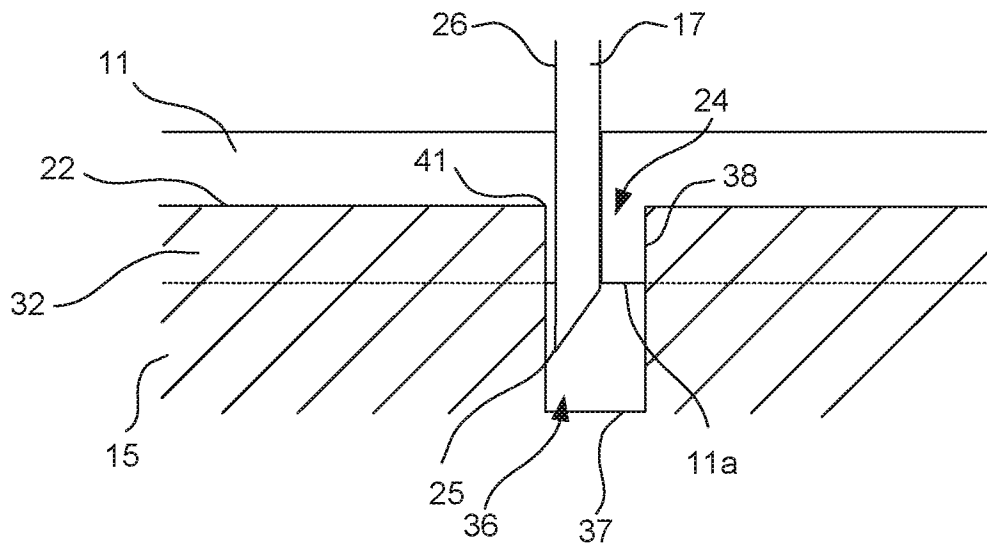


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2017/051448

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B26D1/22 B26D3/08
 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)

B26D A24C A24D

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

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A	DE 26 40 567 A1 (HAUNI WERKE KOERBER & CO KG) 16 March 1978 (1978-03-16) page 7 - page 9; figure 1 -----	7,8,11, 18
X		1-6,8-23
A		7
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

21 July 2017

Date of mailing of the international search report

02/08/2017

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2017/051448

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X A	US 3 712 162 A (GIATTI F) 23 January 1973 (1973-01-23) column 2, line 23 - column 4, line 23; figures 1-4 -----	1-6,8-23 7
X A	WO 2015/165683 A1 (TOBACCO RES & DEV INST PROPRIETARY LTD [ZA]; BRITISH AMERICAN TOBACCO) 5 November 2015 (2015-11-05) page 3, line 17 - column 6, line 18; figures 1-3e -----	1-6,8-23 7

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