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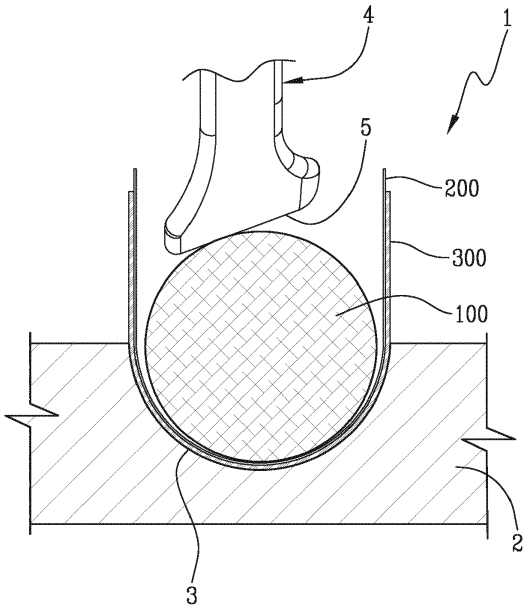
(54) DEVICE AND METHOD FOR PROCESSING A CONTINUOUS SEMI-FINISHED PRODUCT OF THE TOBACCO INDUSTRY

(57) A method for processing a continuous semi-finished product (100) of the tobacco industry, comprising the step of feeding at least one continuous semi-finished product (100) in an open-top guide groove (3) and applying a progressive compressive action on the semi-finished product (100) by means of a presser element (4) which is located above the semi-finished product (100) and which has, on the underside of it, a pressing surface (5) intended to come into sliding contact with the semi-finished product (100), where the pressing surface (5) is stationary and shaped or disposed in such a way as to come into contact with the continuous semi-finished product (100) along a longitudinal contact band or line that is eccentric relative to a longitudinal top line or portion of the semi-finished product (100).

Fig.1



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Description

[0001] This invention relates to a device and a method for processing a continuous semi-finished product of the tobacco industry - in particular, a continuous stream of fibre material (specifically, a stream of filter tow) or a continuous succession of filter segments, for example having different properties, so as to form a succession of composite filters.

[0002] Known in the prior art are devices for processing a continuous stream of filter and disposed in a zone for forming a filter rod: that is to say, a zone where the stream of filter is progressively wrapped in a paper web. These devices are provided with a presser element configured to progressively compress the stream in a direction transverse to the longitudinal axis of the stream so that, when the stream is completely wrapped, its natural springback causes it to eliminate any empty spaces in and to fill the paper tube with a good degree of compression. This also allows optimum control over the final diameter of the paper tube formed, hence of the resulting rod, so as to give it the required diameter size more easily and reliably.

[0003] A device of this kind is described in EP3363303, in the name of this Applicant. The device has a compression finger with a curved transverse cross section and provided with suction holes.

[0004] Document EP2767177 describes a different type of device which uses a train of rollers disposed in sequence along the longitudinal axis of the stream to progressively compact the stream.

[0005] The Applicant has found that prior art devices can be improved to overcome certain disadvantages.

[0006] In particular, a device of the first type, if applied to filter material, may give rise to local heating due to the sliding action between the concave section of the presser element and the outside surface of the filter material, also on account of the increased contact force caused by the pneumatic suction.

[0007] The device of the second type, on the other hand, has moving parts (rollers) which are very sensitive to dust and other waste particles present in the air. In effect, these particles can reach the rolling interfaces (bearings), leading to jamming or unwanted friction preventing the rollers from rolling normally.

[0008] In this context, the basic technical purpose of this invention is to provide a device and a method for processing a continuous semi-finished product of the tobacco industry to overcome the above mentioned disadvantages of the prior art.

[0009] More specifically, the aim of this invention is to provide a device and a method for processing a continuous semi-finished product of the tobacco industry which allow obtaining a high level of reliability and, at the same time, producing a filter rod of optimum quality.

[0010] The technical purpose indicated and the aim specified are substantially achieved by a method for processing a continuous semi-finished product of the tobacco industry comprising the technical features set out in the appended claim 1 or in one or more of the claims dependent thereon, and by a device for processing a continuous semi-finished product of the tobacco industry comprising the technical features set out in claims 8 and 15 or in one or more of the claims dependent thereon.

[0011] Also an object of this invention is a presser element used in the device according to the invention, as set out in one or more of claims 19-21.

[0012] The invention is described below with reference to the accompanying drawings, which illustrate a non-limiting embodiment of it and in which:

- Figure 1 shows a schematic transverse cross section of a processing device according to this invention;
- Figure 2 is an even more schematic representation of the view of Figure 1, intended to highlight geometric aspects;
- Figures 3 and 4 show a component of the device of Figure 1 from two different angles;
- Figure 5 shows a simplified view of the processing device according to this invention in a transverse cross section intended to better illustrate the component of Figures 3 and 4;
- Figure 6 shows a schematic transverse cross section of a different embodiment of a processing device according to this invention.

[0013] With reference to the accompanying drawings, the numeral 1 denotes in its entirety a device for processing a continuous semi-finished product of the tobacco industry according to this invention. The expression "continuous semi-finished product of the tobacco industry" (labelled 100 in the accompanying drawings) is used, in the context of this invention, to denote an intermediate product of undefined length, which can, in particular, be likened to a continuous product having a main direction of longitudinal extension and which is made to advance in that direction. More specifically, in the context of a machine for making filters in a cigarette production plant, the semi-finished product 100 may be:

- a continuous stream of filter, (specifically, filter tow) obtained at the exit of a respective machine for processing a continuous strip of filter fed from bales; or
- a continuous succession of cylindrical filter segments, made by a machine known as "combining machine" and where the filters are aligned with their axes of symmetry along a common longitudinal feed direction; these segments, although discrete, are abutted end to end to define a continuous outer structure.

[0014] In particular, the invention applies in substantially the same way to both of the above possibilities, as well as to other forms of semi-finished product falling within the concept of "continuous semi-finished product".

[0015] As may be seen more clearly in the schematic

illustration of Figure 1, the device 1 comprises a supporting base 2 having an open-top guide groove 3 for longitudinally feeding a respective semi-finished product 100; the guide groove 3 has an arcuate or substantially semicircular shape. More specifically, the device 1 may be a single-track device or, in an embodiment not illustrated, it may be configured as a device with multiple tracks (twin-track or multi-track device) for simultaneously processing two or more continuous semi-finished products in parallel through respective guide grooves running alongside each other.

[0016] More in detail, the device 1 is a device for forming a filter rod and configured to continuously wrap the continuous semi-finished product 100 in a paper web 200 by using a supporting belt 300, according to known technology. The belt 300, which initially lies in a horizontal plane, receives the paper web 200 and the continuous semi-finished product and, through specific fixed guides, is progressively wrapped around the semi-finished product so as to wrap the paper web 200 around the semi-finished product 100 as the semi-finished product 100 is fed forward longitudinally. During this operation, the belt 300 thus adopts an initial configuration where it is flat and lies in a horizontal plane and then a configuration in which it is progressively folded into a U shape and closed on itself.

[0017] The device 1 also comprises, for each guide groove 3, a respective presser element 4 facing the guide groove 3 and shaped and/or disposed in such a way as to define a cross section of decreasing size for the passage of the semi-finished product 100 so as to apply a progressive compressive action on at least one angular portion of the semi-finished product 100 as the semi-finished product advances. The compression is applied on an "angular" portion because, as may be seen in Figures 1, 2 and 5, the contact zone between the presser element 4 and the semi-finished product 100 affects only a small perimeter band of the circular cross section of the semi-finished product 100.

[0018] Advantageously, the presser element 4 has a pressing surface 5 facing the guide groove 3 and intended to come into sliding contact with the advancing semi-finished product 100 and to apply the progressive compressive action on the semi-finished product 100. The pressing surface 5 is thus adapted to come into contact with the semi-finished product 100 along a longitudinal contact zone which, in particular, is ideally a contact line identified by the tangency between the tubular surface of the semi-finished product 100 and the flat pressing surface 5 but which, in actual fact, is a contact surface defined by the local deformation caused by the flattening of the compressed zone of the semi-finished product 100.

[0019] More specifically, the pressing surface 5 is oriented convergently with the guide groove 3 in such a way that its distance from the guide groove 3 decreases along the feed direction of the semi-finished product 100 to create a channel with a cross section of decreasing size for the passage of the semi-finished product 100.

[0020] In order to apply compression on the outside surface of the semi-finished product 100, the presser element 4 is disposed at a position on the device 1 where the paper web is wrapped partly, or into a U shape, around the semi-finished product 100 in such a way that an upper portion of the semi-finished product 100 not yet wrapped in the paper web comes into contact with the pressing surface 5 of the presser element 4.

[0021] In order to optimize the compression process, at least the pressing surface 5 is made of stainless steel or a material having a low friction coefficient: for example, a polymeric material such as PTFE.

[0022] The pressing surface 5 is preferably quadrangular, specifically in the shape of a rectangle or trapezium. In the embodiment illustrated in the accompanying drawings, the pressing surface 5 has the shape of a trapezium of width "l" variable along the feed direction of the semi-finished product 100. The width "l" preferably increases in the feed direction of the semi-finished product 100 so that the semi-finished product 100, as it advances, undergoes progressively increasing compression on its surface.

[0023] Preferably, the pressing surface 5 has a length "L", measured parallel to the guide groove 3, of between 30 mm and 100 mm and/or a width "l", measured perpendicularly to the guide groove 3, of between 2 mm and 10 mm.

[0024] Preferably, also, the pressing surface 5 has rounded zones at the side and/or at the front and/or at the rear.

[0025] As may be seen in particular in Figure 2, the pressing surface 5 is inclined at a pressure angle "α" of between 2° and 60°, preferably between 10° and 50° and still more preferably, between 20° and 30°, relative to a horizontal plane. That means a corresponding (complementary) angle, relative to a vertical plane or longitudinal symmetry of the guide groove 3, of between 30° and 88°, preferably between 40° and 80° and still more preferably, between 60° and 70°. In effect, it is assumed that the base 2 defining the guide groove 3 lies in a horizontal plane or, in any case, that the guide groove 3 has a vertical plane of symmetry.

[0026] Further, the pressing surface 5 is laterally decentred relative to a vertical midplane of the guide groove 3, specifically to the left in the views of Figures 1, 2 and 5. In effect, in this situation, the pressing surface 5 has a longitudinal centre line which is permanently decentred relative to the vertical midplane of the guide groove 3.

[0027] In an embodiment, the presser element 4 is movable translationally towards and away from the guide groove 3 by means of respective actuating means (not illustrated) for varying the distance between the pressing surface 5 and the guide groove 3.

[0028] In another embodiment, the presser element 4 is adjustable about an adjustment axis, parallel to the guide groove 3 or to a longitudinal centre axis of the pressing surface 5, in order to vary the pressure angle "α".

[0029] Figures 3-5 illustrate a preferred embodiment of the presser element 4, where the presser element has a bottom portion 6 defining the pressing surface 5 and a top portion 7 rigidly connected to the bottom portion 6 and mounted on a frame (not illustrated) of the device 1 and where the bottom portion 6 and the top portion 7 are made as a monolithic part.

[0030] The monolithic part may be made of metallic material or of another material: for example, an anti-friction material. In an embodiment, the monolithic part may be made of a generic material - for example, steel - and lined, on the underside of it, with an anti-friction material defining the pressing surface 5.

[0031] The top surface 7 may be defined by a rib or mounting plate having its own positioning plane, making with the pressing surface 5 an inclination angle "β" of between 30° and 88°, preferably between 40° and 80° and still more preferably, between 60° and 70°. The inclination angle "β" is the complementary angle of the pressure angle "α" when the mounting plate is oriented vertically.

[0032] Figure 6 illustrates a different embodiment of the device according to the invention, differing from the embodiment illustrated in Figures 1-5 in that the pressing surface 5 has a concave shape, with concavity directed towards the semi-finished product 100 and curvature smaller than that of the semi-finished product 100. In a preferred embodiment, the pressing surface 5 has a transverse cross section in the shape of a circular arc whose radius is larger than the radius of the semi-finished product 100.

[0033] In this embodiment, also, the pressing surface 5 has an axis of revolution (oriented longitudinally along the semi-finished product 100 and preferably parallel or substantially parallel therewith), labelled C2 in Figure 6 and the axis of revolution C2 is disposed eccentrically relative to the position plane of the mounting plate of the upper portion 7 to which the lower portion 6, defining the pressing surface 5, is fixed.

[0034] Considering the device 1 as a whole, in the cross section view of Figure 6, the axis of revolution C2 of the pressing surface 5 is also disposed eccentrically relative to a vertical plane and/or a longitudinal midplane of the guide groove 3, passing, in particular, through the longitudinal axis C1 of the semi-finished product 100.

[0035] In use, the semi-finished product 100 is made to advance along a feed direction inside the guide groove 3 and, as it advances, the semi-finished product 100 is progressively compressed by the presser element 4, disposed above the semi-finished product 100.

[0036] The step of applying a progressive compressive action on the semi-finished product 100 is carried out during a step of wrapping the semi-finished product (100) in a continuous paper web 200, specifically before the semi-finished product 100 is completely wrapped in the continuous paper web 200, at an instant in which the paper web 200 is wrapped partly, or in a U shape, around the semi-finished product 100 in such a way that a top portion of the semi-finished product 100 not yet wrapped in the paper web 200 comes into contact with the pressing surface 5 of the presser element 4.

[0037] Furthermore, the progressive compressive action is applied on the semi-finished product 100 by disposing the pressing surface 5 in contact with the continuous semi-finished product 100 on a contact zone or line (defined by the tangency between the pressing surface 5 and the semi-finished product 100) which is eccentric relative a longitudinal (vertical) midplane of the guide groove 3: that is to say, laterally (angularly) offset relative to the longitudinal midplane. More specifically, the contact line is angularly offset relative to a longitudinal top line of the semi-finished product 100 (or relative to a vertical plane) by an offset angle "γ" that is ideally equal to the pressure angle "α".

[0038] This, in the embodiment of Figures 1-5, is accomplished by disposing the pressing surface 5 so it lies in a plane that is inclined at the pressure angle "α" to the vertical plane and/or by laterally offsetting the pressing surface 5 relative to the vertical midplane of the guide groove 3.

[0039] In the embodiment of Figure 6, this is accomplished by disposing the axis of revolution of the pressing surface 5 eccentrically relative to the position plane of the mounting plate and/or relative to a vertical plane and/or a longitudinal midplane of the guide groove 3.

[0040] The step of applying a progressive compressive action on the semi-finished product 100 is preceded by a step of adjusting a mutual distance and/or angle between the pressing surface 5 and the respective guide groove 3.

[0041] This invention achieves the preset aims by overcoming the disadvantages of the prior art.

[0042] Making the presser element (or finger) in the form of a stationary part provided with a flat pressing surface enhances the reliability of the compression process (heating is reduced and there are no moving parts).

[0043] Also, the inclination of the surface in combination with its flat position plane has the effect of optimizing the result of the compression process, which occurs gradually on a zone of the semi-finished product laterally offset relative to the top and, thanks to the flat shape of the pressing surface, without score marks or other invasive actions on the surface of the semi-finished product. The inclination also has the effect of applying a lateral pushing action on the semi-finished product, opposite to the simultaneous folding action of the inner edge of the paper web being wrapped around it.

[0044] Moreover, the presence of rounded zones at the edges of the pressing surface improves the properties of the finished semi-finished product: in particular, the (convex) curvature on the trailing side prevents dust/glue residues deposited during the preceding formation process from accumulating.

Claims

1. A method for processing a continuous semi-finished product (100) of the tobacco industry, specifically a continuous stream of filter or a continuous succession of filter segments, comprising the step of feeding at least one continuous semi-finished product (100) along a feed direction in an open-top guide groove (3) and, as the semi-finished product (100) advances, applying a progressive compressive action on the semi-finished product (100) by means of a presser element (4) which is located above the semi-finished product (100) and which has, on the underside of it, a pressing surface (5) facing the guide groove (3) and intended to come into sliding contact with the advancing semi-finished product (100) and to apply the progressive compressive action on the semi-finished product (100), **characterized in that** the pressing surface (5) is stationary and shaped or disposed in such a way as to come into contact with the continuous semi-finished product (100) along a longitudinal contact band or line that is eccentric relative to a longitudinal top line or portion of the semi-finished product (100).

2. The method according to claim 1, wherein the longitudinal contact band or line is angularly spaced by an offset angle (γ) of between 2° and 60°, preferably between 10° and 50° and still more preferably, between 20° and 30°, relative to a vertical plane of symmetry of the semi-finished product (100) and/or of the guide groove (3).

3. The method according to claim 1 or 2, wherein the pressing surface (5) is planar.

4. The method according to claim 1 or 2, wherein the pressing surface (5) has a concave shape, with concavity facing towards the semi-finished product (100) and preferably having a cross section in the shape of a circular arc whose radius is greater than the radius of the semi-finished product (100).

5. The method according to one or more of the preceding claims, wherein the step of applying a progressive compressive action on the semi-finished product (100) is carried out during a step of wrapping the semi-finished product (100) in a continuous paper web (200), specifically before the semi-finished product (100) is completely wrapped in the continuous paper web (200), at an instant in which the paper web (200) is wrapped partly, or in a U shape, around the semi-finished product (100) in such a way that a top portion of the semi-finished product (100) not yet wrapped in the paper web (200) comes into contact with the pressing surface (5) of the presser element (4).

6. The method according to one or more of the preceding claims, wherein the step of applying a progressive compressive action on the semi-finished product (100) is carried out by positioning the pressing surface at a pressure angle (α) of between 2° and 60°, preferably between 10° and 50° and still more preferably, between 20° and 30°, relative to a horizontal plane.

7. The method according to one or more of the preceding claims, wherein the step of applying a progressive compressive action on the semi-finished product (100) is preceded by a step of adjusting a mutual distance and/or angle between the pressing surface (5) and the respective guide groove (3).

8. A device (1) for processing a continuous semi-finished product (100) of the tobacco industry, specifically a continuous stream of filter or a continuous succession of filter segments, comprising a supporting base (2) having at least guide groove (3) for longitudinally feeding a respective continuous semi-finished product (100) and, associated with the at least one guide groove (3), a respective stationary presser element (4) facing the guide groove (3) and shaped and/or disposed in such a way as to define a cross section of decreasing size for the passage of the semi-finished product (100) so as to apply a progressive compressive action on at least a portion of the semi-finished product (100) as the semi-finished product (100) advances, wherein the presser element (4) has a pressing surface (5) facing the guide groove (3) and intended to come into sliding contact with the advancing semi-finished product (100) and to apply the progressive compressive action on the semi-finished product (100), **characterized in that** the pressing surface (5) is stationary, planar and inclined at a pressure angle (α) of between 2° and 60°, preferably between 10° and 50° and still more preferably, between 20° and 30°, relative to a horizontal plane.

9. The device according to claim 8, wherein the pressing surface (5) has a quadrangular shape, preferably rectangular or trapezium shaped, and is provided at the side and/or at the front and/or at the back with rounded edge zones.

10. The device according to claim 8 or 9, wherein the presser element (4) has a bottom portion (6) defining the pressing surface (5) and a top portion (7) rigidly connected to the bottom portion (6) and mounted on a frame of the device (1) and wherein the bottom portion (6) and the top portion (7) are made as a monolithic part.

11. The device according to any one of claims 8 to 10, wherein the shape of the pressing surface (5) has a

width (l) that is variable along the feed direction of the semi-finished product (100), the width (l) preferably increasing in the feed direction of the semi-finished product (100) so that the semi-finished product (100), as it advances, undergoes compression over a progressively increasing extent.

12. The device according to any one of claims 8 to 11, wherein the pressing surface (5) has a length (L), measured parallel to the guide groove (3), of between 30 mm and 100 mm and/or a width (l), measured perpendicularly to the guide groove (3), of between 2 mm and 10 mm.

13. The device according to any one of claims 8 to 12, wherein the presser element (4) is movable translationally towards and away from the guide groove (3) by means of respective actuating means for varying the distance between the pressing surface (5) and the guide groove (3).

14. The device according to one or more of claims 8 to 13, wherein the presser element (4) is adjustable about an adjustment axis, parallel to the guide groove (3) or to a longitudinal centre axis of the pressing surface (5), in order to vary the pressure angle (α).

15. A device (1) for processing a continuous semi-finished product (100) of the tobacco industry, specifically a continuous stream of filter or a continuous succession of filter segments, comprising a supporting base (2) having at least one guide groove (3) for longitudinally feeding a respective continuous semi-finished product (100) and, associated with the at least one guide groove (3), a respective stationary presser element (4) facing the guide groove (3) and shaped and/or disposed in such a way as to define a cross section of decreasing size for the passage of the semi-finished product (100) so as to apply a progressive compressive action on at least a portion of the semi-finished product (100) as the semi-finished product (100) advances, wherein the presser element (4) has a pressing surface (5) facing the guide groove (3) and intended to come into sliding contact with the advancing semi-finished product (100) and to apply the progressive compressive action on the semi-finished product (100), **characterized in that** the pressing surface (5) is stationary, has a concave shape, with concavity facing towards the semi-finished product (100) and having a cross section preferably in the shape of a circular arc, and disposed in such a way as to come into contact with the continuous semi-finished product (100) along a longitudinal contact band or line that is eccentric relative to a vertical plane and/or a longitudinal midplane of the guide groove (3).

16. The device according to claim 15, wherein the pressing surface has an axis of revolution and wherein the axis of revolution is disposed at a position that is eccentric relative to a vertical plane and/or a longitudinal midplane of the guide groove (3).

17. The device according to any one of claims 8 to 16, configured as a multi-line device and comprising two or more parallel guide grooves (3) for feeding respective continuous semi-finished products (100) and, for each guide groove (3), a respective presser element (4) facing the respective guide groove (3) and shaped and/or disposed in such a way as to apply a progressive compressive action on at least a portion of the semi-finished product (100).

18. A machine for making filters in a cigarette production plant, comprising a unit for forming a continuous semi-finished product (100), specifically a continuous stream of filter or a continuous succession of filter segments and, downstream of the unit for forming a continuous semi-finished product (100), a device (1) according to one or more of claims 8 to 17, wherein the device is a device for forming at least one filter rod and configured to continuously wrap the continuous semi-finished product (100) in a paper web (200), the presser element (4) being disposed on the device (1) at a position where the paper web (200) is wrapped partly, or in a U shape, around the semi-finished product (100) in such a way that a top portion of the semi-finished product (100) not yet wrapped in the paper web (200) comes into contact with the pressing surface (5) of the presser element (4).

19. A presser element (4) for processing a continuous semi-finished product of the tobacco industry, specifically a continuous stream of filter or a continuous succession of filter segments, comprising:

- a bottom portion (6) having on the underside of it a stationary pressing surface (5) which is planar and intended to come into sliding contact with the advancing semi-finished product (100) and to apply a progressive compressive action on the semi-finished product (100) as the semi-finished product (100) advances; and
- a top portion (7) rigidly connected to the bottom portion (6) and mounted on a supporting frame;

characterized in that the top portion (7) is at least partly defined by a mounting plate having a main position plane and **in that** the pressing surface (5) is inclined, relative to the main position plane of the mounting plate, at an inclination angle (β) of between 30° and 88°, preferably between 40° and 80° and still more preferably, between 60° and 70°.

20. A presser element (4) for processing a continuous semi-finished product of the tobacco industry, specifically a continuous stream of filter or a continuous succession of filter segments, comprising:

- a bottom portion (6) having on the underside of it a pressing surface (5) intended to come into sliding contact with the advancing semi-finished product (100) and to apply a progressive compressive action on the semi-finished product (100) as the semi-finished product (100) advances;and
- a top portion (7) rigidly connected to the bottom portion (6) and mounted on a supporting frame; **characterized in that** the top portion (7) is at least partly defined by a mounting plate having a main position plane and **in that** the pressing surface (5) is stationary and has a transverse cross section in the shape of a circular arc whose concavity faces towards the semi-finished product (100), the pressing surface (5) being also shaped and/or disposed in such a way as to have an axis of revolution disposed at a position that is eccentric relative to the main position plane of the mounting plate.

21. The presser element according to claim 19 or 20, wherein the bottom portion (6) and the top portion (7) are made as a monolithic part.

Fig.2

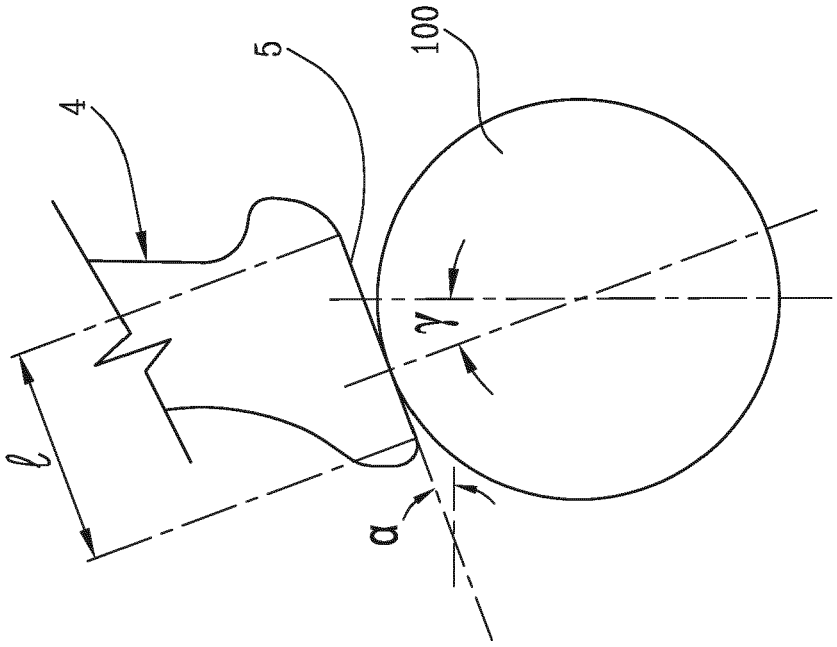


Fig.1

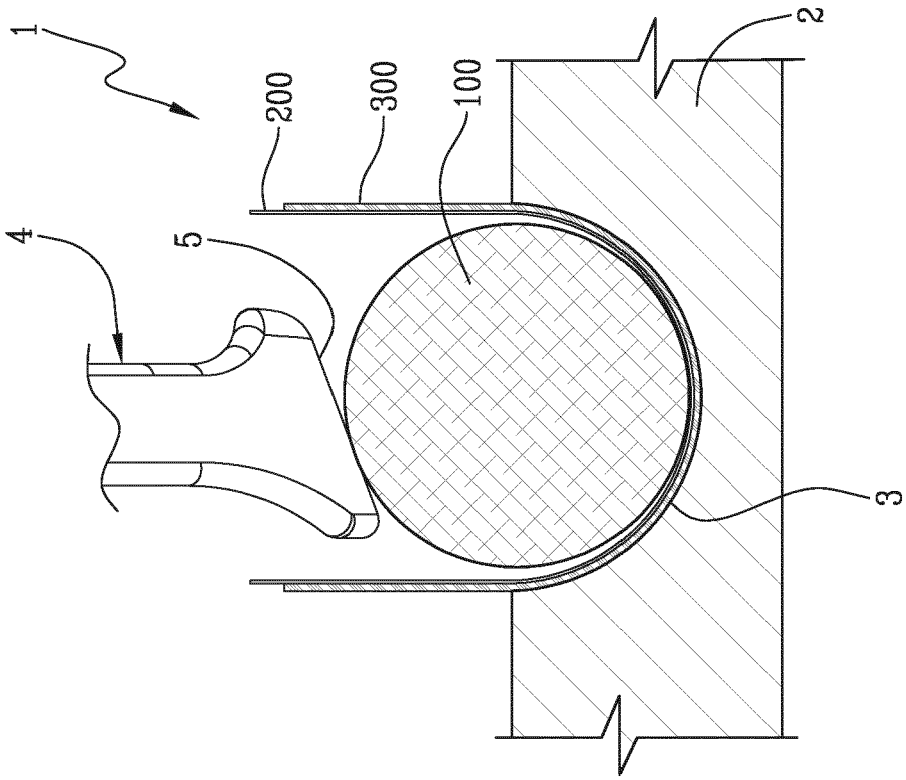


Fig.5

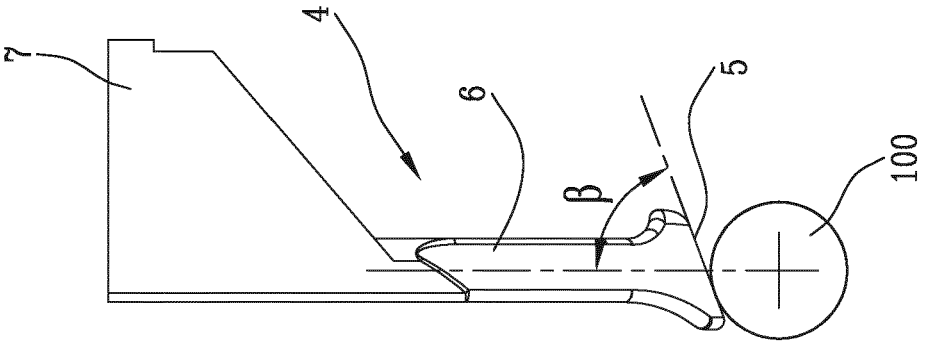


Fig.4

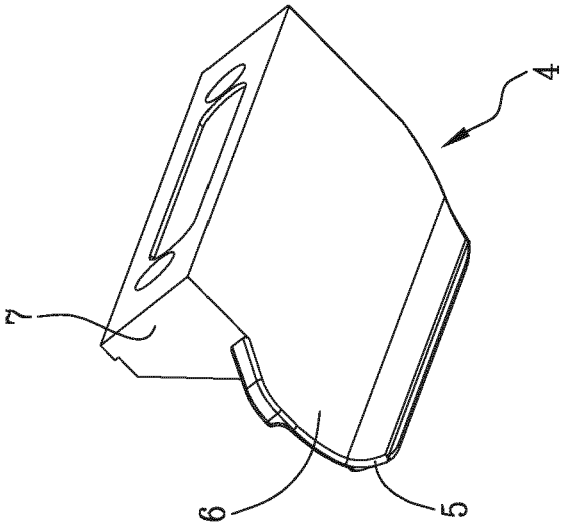


Fig.3

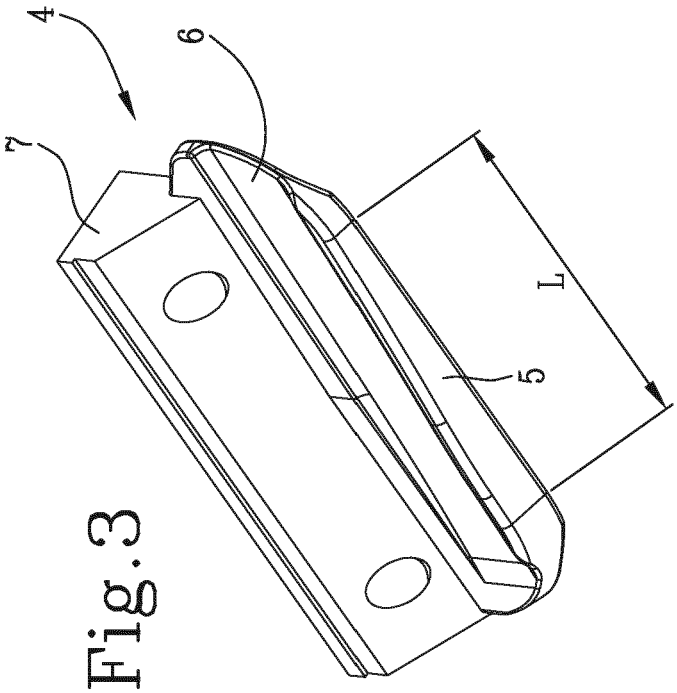
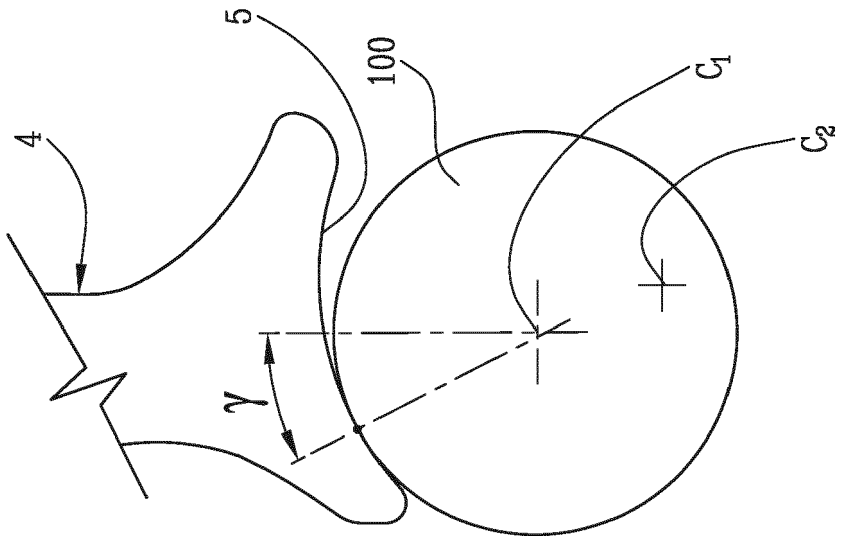


Fig.6



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EUROPEAN SEARCH REPORT

Application Number
EP 20 16 9922

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	EP 3 363 303 A1 (GD SPA [IT]) 22 August 2018 (2018-08-22) * paragraph [0045] - paragraph [0046]; claims; figures * * paragraph [0066] - paragraph [0069] *	1-21	INV. A24D3/02
A	WO 2014/199284 A1 (INT TOBACCO MACHINERY POLAND [PL]) 18 December 2014 (2014-12-18) * page 4, line 7 - page 6, line 3; claims; figures *	1-21	
A,D	EP 2 767 177 A1 (INT TOBACCO MACHINERY POLAND [PL]) 20 August 2014 (2014-08-20) * paragraph [0024] - paragraph [0025]; claims; figures *	1-21	
A	EP 2 057 908 A1 (JAPAN FILTER TECHNOLOGY LTD [JP]) 13 May 2009 (2009-05-13) * paragraph [0038]; figures *	7,13	

TECHNICAL FIELDS SEARCHED (IPC)

A24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 September 2020	Marzano Monterosso

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