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(54) MULTILAYER TUBE OF THE TOBACCO INDUSTRY AND METHOD FOR MAKING THE MULTILAYER TUBE

MEHRSCICHTIGES ROHR DER TABAKVERARBEITENDEN INDUSTRIE UND VERFAHREN ZUR HERSTELLUNG DES MEHRSCICHTIGEN ROHRES

TUBE MULTICOUCHE DE L'INDUSTRIE DU TABAC ET PROCÉDÉ DE FABRICATION DU TUBE MULTICOUCHE

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(56) References cited:
EP-A2- 3 033 952 WO-A1-2013/156912
GB-A- 1 538 452 GB-A- 1 556 728

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Description

Technical field

[0001] This invention relates to a multilayer tube of the tobacco industry and to a method for making it.

Background art

[0002] Known in the tobacco industry is the need for tube-shaped elements of paper material, in particular for use as components of "HNB" (heat-not-burn) cigarettes. For increased strength, these tube-shaped elements are made with a multilayer structure.

[0003] Generally speaking, the tube-shaped elements are made by superposing and gluing two paper webs in such a way as to obtain, on one or both of the longitudinal edges, suitable joining zones intended to be spliced to each other to form a tube-like configuration.

[0004] Also, to obtain a shape that is as cylindrical as possible, the two webs are offset during superposing and gluing, so that, when the tube is formed, the splices between the corresponding end edges of the two layers are angularly spaced from each other about the axis of the tube itself.

[0005] These known production methods, however, have the disadvantage of not guaranteeing sufficient precision in the final shape of the tube, especially in terms of precise size and superposition of the two webs. In effect, if the two webs are of the wrong size or incorrectly positioned relative to each other, the final shape will likely be irregular, and the edges of the layers not properly juxtaposed, resulting in a poor connection in the splicing zones.

[0006] Two-layer tubes known in the art are disclosed by GB1538452 and GB1556728. These tubes are formed by longitudinally enfolding a two-layered web obtained by folding a web about a longitudinal folding line.

Aim of the invention

[0007] In this context, the basic technical purpose of this invention is to provide a multilayer tube of the tobacco industry, as well as a method for making it, to overcome the above mentioned disadvantages of the prior art.

[0008] More specifically, this invention has for an aim to provide a multilayer tube of the tobacco industry, as well as a method for making it, capable of guaranteeing a high level of dimensional precision of the end product.

[0009] The technical purpose indicated and the aims specified are substantially achieved by a multilayer tube of the tobacco industry and a method for making it, comprising the technical features described in claims 1 and 14, respectively, and/or in one or more of the claims dependent thereon.

[0010] In particular, the object of this invention is a multilayer tube of the tobacco industry, which has an internally hollow cylindrical shape extending round a longitu-

dinal axis and whose cross section transverse to the longitudinal axis has a multilayer thickness defined by at least three superposed layers, the tube being obtained by winding a (preferably flat) multilayer material around the longitudinal axis until juxtaposing and coupling to each other opposite lateral edges of the flat multilayer material, wherein the flat multilayer material is obtained by folding a single sheet or web about at least two fold lines parallel to the longitudinal axis to superpose corresponding longitudinal zones of the sheet or web and define the multilayer thickness. In an embodiment, the multilayer tube is obtained by cutting a continuous tube made from a continuous multilayer (three-layer) web. In a different embodiment, the multilayer tube may be obtained from a multilayer (three-layer) sheet or piece of material which may in turn be obtained by cutting a continuous multilayer (three-layer) web.

[0011] The superposed layers of the tube extend along paths which are concentric about the longitudinal axis. The concentric paths are defined by respective cylindrical surfaces of each layer and, in particular, the flat multilayer material is wound around the longitudinal axis "X" in such a way that mutually juxtaposing and coupling the opposite lateral edges of the flat multilayer material causes each layer to lie on a respective closed cylindrical positioning surface. That means the cylindrical positioning surfaces of the layers are concentric about the longitudinal axis. Thanks to this, in the splicing zone between the two lateral edges of the multilayer material, there is a "flush" join between the two lateral edges at least on the outside of the tube and preferably also on the inside of it. In other words, there is no step in the splicing zone on the outside, and preferably also on the inside, so as to obtain a circumferentially smooth tube.

[0012] Also, mutually adjacent layers are joined together along a respective folding zone extending parallel to the longitudinal axis (and disposed at one lateral edge of the multilayer web) and integral with the adjacent layers in such a way that each layer constitutes an extension of at least one adjacent layer. Advantageously, the layers are defined by folding a single sheet or web and each layer of adjacent layers defines an extension of the other through a respective curvature/folding zone disposed on one side of, and parallel to, the longitudinal axis. That means the layers are not disposed spirally; in other words, the multilayer structure of the tube is not obtained by a spiral configuration of a single sheet or web.

[0013] Preferably, the initial sheet or web has a single layer configuration and is made, for example, of paper material.

[0014] In a preferred embodiment, one of the layers has, along a first lateral edge of the multilayer web, a lateral border protruding from an adjacent layer, the protruding lateral border defining an element for joining the opposite lateral edges of the multilayer material so as to circumferentially close the tube. Preferably, the first protruding lateral border is a lateral border of the initial web from which the multilayer web was made. Under these

circumstances, the protruding lateral border defining the joining element has a single layer configuration and is defined by an extension of only one of the layers.

[0015] In this embodiment, the multilayer web is provided, on the second lateral edge of it, opposite to and facing the first lateral edge, with a recess corresponding to the protruding lateral border so that the protruding lateral border is positioned in the recess, giving the tube a smooth, crease-free circular configuration at the zone where the lateral edges are spliced.

[0016] In an embodiment, not forming part of the invention, the cross section of the tube transverse to the longitudinal axis has a thickness defined by two superposed layers and the flat multilayer material is obtained by folding a single sheet or web about a fold line parallel to the longitudinal axis to superpose a pair of adjacent longitudinal zones of that sheet or web.

[0017] According with the invention, the cross section of the tube transverse to the longitudinal axis has a thickness defined by three superposed layers and the flat multilayer material is obtained by folding a single sheet or web about two fold lines parallel to the longitudinal axis to superpose corresponding longitudinal zones of that sheet or web, which are adjacent to each other and separated by those fold lines.

[0018] In a possible embodiment of the three-layer solution, the multilayer material is obtained by folding a single sheet or web about the parallel fold lines in such a way that the layers follow each other along an S-shaped path, where the outer layers correspond to outer longitudinal areas of the sheet or web while the intermediate layer corresponds to a central longitudinal area of the sheet or web.

[0019] Preferably, a first of the outer layers is larger in width than the intermediate layer to define a protruding lateral border defining an element for joining the opposite sides of the multilayer material so as to circumferentially close the tube.

[0020] Preferably, also, the second outer layer is smaller in width than the intermediate layer and defines a retracted edge behind a folding and splicing zone between the other two layers and the folding and splicing zone adopts, in that tube, a deformed, double notch configuration (that is to say, an inner notch and an outer notch) to define, on one side, a recessed zone designed to receive the protruding lateral border of the first outer layer and, on the other side, a relief feature designed to be aligned with the second outer layer.

[0021] In a different, three-layer embodiment, the multilayer material is obtained by folding a single sheet or web about the parallel fold lines in such a way that the layers follow each other along a spiral path, where the outer layers correspond to a first outer longitudinal area and a central longitudinal area of the sheet or web, respectively, while the intermediate layer corresponds to a second outer longitudinal area of the sheet or web.

[0022] Preferably, the central layer is smaller in width than the outer layers so that the free inner edge of the

central layer is spaced from the fold line between the outer layers to define a recessed zone of a first of the outer layers; the first outer layer having, on the side opposite to the recessed zone, a protruding lateral border coupled to the recessed zone of the first layer to define an element for joining the opposite sides of the multilayer material so as to circumferentially close the tube.

[0023] In the embodiment just described, the first layer may define the innermost layer of the three-layer tube. Alternatively, the first layer may define the outermost layer of the three-layer tube.

[0024] Preferably, in each of the embodiments, the layers are permanently connected to each other by applying an adhesive substance, specifically according to a predetermined pattern and preferably by applying an uninterrupted layer of glue. In particular, the adhesive substance is applied between each pair of adjacent layers in such a way that the multilayer structure is defined before winding around the longitudinal axis to define the tube, which will adopt a stable configuration after being formed and when the glue dries.

[0025] Further, the joining element too, is used to close the tube made from the multilayer web by means of a line or layer of glue (laminating glue).

[0026] In an embodiment, the glue used to join the layers to each other and the glue used to fix the joining element may be different kinds of glue.

[0027] This invention also has for an object a method for making a multilayer tube of the tobacco industry and, in particular, a tube of the type described above. The method comprises the steps of:

- feeding a continuous web along a feed direction;
- folding the continuous web on itself about at least a first longitudinal fold line, parallel to the feed direction, while the continuous web is being fed, until obtaining a multilayer web defined by superposing at least a first longitudinal area and a second longitudinal area of the continuous web;
- winding the multilayer web around a longitudinal axis parallel to the feed direction until mutually juxtaposing opposite edges of the multilayer web;
- stably connecting the opposite edges of the multilayer web to each other.

[0028] Advantageously, the step of folding the continuous web along the at least one first longitudinal fold line is carried out while the web is being fed. This is accomplished by folding means such as, for example, a progressively-acting, fixed diverter which folds a longitudinal band of the web against a fixed laminator such as, for example, a fixed plate.

[0029] In a first embodiment, not forming part of the invention, the continuous web is folded about a single longitudinal fold line to obtain a two-layer web.

[0030] In a different embodiment, according with the invention, the continuous web is folded about two longi-

tudinal fold lines to obtain a three-layer web. In this embodiment, the step of folding the continuous web is accomplished by folding the web a first time about a first longitudinal fold line and folding the web again about a second longitudinal fold line in such a way as to obtain a three-layer web, the first and second fold lines being parallel to each other and parallel to the feed direction of the continuous web.

[0031] Preferably, the step of folding is accomplished by folding the web around at least one laminator, preferably a thin, longitudinal plate, so that the respective fold line is located at a respective longitudinal edge of the rigid laminator.

[0032] Advantageously, each step of folding is preceded by a step of making at least one longitudinal line of weakness to coincide with a respective longitudinal fold line during the step of folding. This longitudinal line of weakness is operatively disposed at the respective longitudinal edge of the rigid laminator so as to maximize folding precision.

[0033] In the three-layer embodiment, both of the fold lines are preferably located at respective longitudinal lines of weakness made previously by a single scoring tool, specifically a single scoring roller having at least two discs or ridges which are axially spaced from each other to make corresponding parallel lines of weakness (scores) on the web. This ensures obtaining an optimum geometry for folding the web to make the three-layer web.

[0034] In an embodiment, the step of folding the web is accomplished by folding the web about the two fold lines in such a way that a central area of the web lying between the two fold lines defines the intermediate layer of the final three-layer web, while the remaining longitudinal areas of the web, which are on the outer sides of the two fold lines, define the outer layers of the three-layer web. In the three-layer web thus obtained, the layers follow each other along an S-shaped path.

[0035] Preferably, in this embodiment, a first of the outer layers is larger in width than the intermediate layer (perpendicularly to the direction of web extension or feed) to define a protruding lateral border defining an element for joining the opposite sides of the multilayer material so as to circumferentially close the tube.

[0036] In order to accommodate the protruding lateral border, the second outer layer is, in an embodiment, smaller in width than the intermediate layer and defines a retracted edge behind a folding and splicing zone between the other two layers and the step of winding the multilayer web includes a step of deforming the folding and splicing zone in such a way as to obtain a deformed, double notch configuration (that is to say, an inward facing notch and an outward facing notch) to define, on one side, a recessed zone designed to receive the protruding lateral border of the first outer layer and, on the other side, a relief feature designed to be aligned with the second outer layer.

[0037] In a different embodiment, the step of folding the web is accomplished by folding the web about the

two fold lines in such a way that the outer layers of the three-layer web correspond, respectively, to a first outer longitudinal area and a central longitudinal area of the web, while the intermediate layer corresponds to a second outer longitudinal area of the three-layer web. In the three-layer web thus obtained, the layers follow each other along a spiral path.

[0038] Preferably, in this embodiment, too, a first of the outer layers is larger in width than the intermediate layer (perpendicularly to the direction of web extension or feed) to define a protruding lateral border defining an element for joining the opposite sides of the multilayer material so as to circumferentially close the tube to define a cavity.

[0039] In order to accommodate the protruding lateral border, the central layer is, in an embodiment, smaller in width than the outer layers so that the free inner edge of the central layer is spaced from the fold and splicing line between the outer layers. In this situation, the step of winding the multilayer web includes a step of deforming the three-layer web at the cavity by flattening to obtain a recessed zone, while one of the two outer layers has, on the side opposite to the recessed zone, a protruding lateral border coupled to the recessed zone of the first layer to define an element for joining the opposite sides of the three-layer material so as to circumferentially close the tube. In other words, the recessed zone defined by flattening at the cavity produces a notch intended to receive the protruding lateral border so that after being wound into a tube, the tube has a smooth, regular, crease-free shape.

[0040] The outer layer defining the protruding lateral border may be the layer intended to be the outside layer of the tube or, alternatively, the layer intended to be the inside layer of the tube.

[0041] Preferably, the step of folding the continuous web on itself about at least a first longitudinal fold line is associated with a step of applying adhesive, preferably an uninterrupted intermediate layer of adhesive, between adjacent layers of the multilayer web. This layer of glue is applied on each superposed layer in order to stabilize the multilayer configuration of the web. In a preferred embodiment of the method, the initial web has a double width and is cut longitudinally into two juxtaposed webs which are then offset in a direction transverse to the position plane of the initial web (that is to say, by raising one of the two webs relative to the other). In this situation, the two webs are each folded according to the process described above to obtain two multilayer webs that are preferably identical.

Brief description of the drawings

[0042] The invention is described below with reference to the accompanying drawings, which illustrate a non-limiting embodiment of it, in which:

- Figure 1 shows a cross section of a first embodiment of a tube according to this invention;

- Figure 1A shows an enlarged view of a detail of the tube of Figure 1;
- Figures 2-4 show a sequence of operations for making the tube of Figure 1;
- Figure 5 shows a cross section of a second embodiment of a tube according to this invention;
- Figure 5A shows an enlarged view of a detail of the tube of Figure 5;
- Figures 6-8 show a sequence of operations for making the tube of Figure 5;
- Figure 9 shows a cross section of a third embodiment of a tube according to this invention;
- Figure 9A shows an enlarged view of a detail of the tube of Figure 9;
- Figures 10-12 show a sequence of operations for making the tube of Figure 9;
- Figure 13 shows a schematic view of a portion of a machine for making a tube according to this invention.

Detailed description of preferred embodiments of the invention

[0043] The accompanying drawings illustrate different embodiments of a tube according to this invention. In the different embodiments, the parts which are the same are denoted by the same reference numbers.

[0044] Figure 1 shows a cross section of a first embodiment of a tube according to this invention, denoted by the reference numeral 1.

[0045] In this embodiment, the tube 1 has an internally hollow, cylindrical shape which extends around a longitudinal axis "X" and whose cross section transverse to the longitudinal axis "X" has a three-layer thickness defined by three superposed layers, specifically an outside layer 2, an intermediate layer 3 and an inside layer 4. The superposed layers 2, 3, 4 extend along paths which are concentric to each other.

[0046] The tube 1 is obtained by winding a flat, three-layer material 100 (Figure 3) around the longitudinal axis "X" until juxtaposing and coupling to each other opposite lateral edges 110, 120 of the flat multilayer material 100.

[0047] The flat, three-layer material 100 is in turn obtained by folding a single sheet or web 50 about a first fold line "P1" and a second fold line "P2", which are parallel to each other and to the longitudinal axis "X", in such a way as to mutually superpose corresponding longitudinal areas of the sheet or web 50 to define the three-layer material. In this configuration, the inner and outer layers 2, 4 correspond to longitudinal outside areas of the sheet or web 50, whilst the intermediate layer 3 corresponds to a longitudinal, central area of the sheet or web 50.

[0048] As shown in Figures 2 and 3, the multilayer material 100 is obtained by folding the sheet or web 50 about the two fold lines "P1", "P2" in such a way that the layers 2, 3, 4 follow each other along an S-shaped path.

[0049] The initial sheet or web 50 preferably has a sin-

gle layer configuration and is made, for example, of paper material.

[0050] The layers 2, 3, 4 of the three-layer material 100 are disposed in such a way that mutually adjacent layers are joined together along a respective folding zone extending parallel to the longitudinal axis "X" and integral with the adjacent layers in such a way that each layer constitutes an extension of at least one adjacent layer. Looking in more detail at the cross section of the multilayer material 100, the end edges 110, 120 each have a respective folding zone between two adjacent layers 2, 3; 3, 4.

[0051] One of the layers, specifically the inside layer 4 has, along a first lateral edge 110 of the multilayer web 100, a lateral border 5 protruding from the intermediate layer 3 to define an element for joining the opposite lateral edges 110, 120 of the multilayer material 100 so as to circumferentially close the tube 1.

[0052] The protruding border 5 has a single layer configuration and is defined by an extension of only one of the layers, specifically the inside layer 4 (or alternatively, in an equivalent embodiment not illustrated, the outside layer). Similarly, the opposite layer (specifically, the outside layer 2 in the configuration of Figures 1-4) is smaller in width than the intermediate layer 3 to define a retracted lateral edge 6 behind a folding and splicing zone between the other two layers 3, 4 (that is to say, behind the corresponding lateral edge 120). Also, in the wound configuration defining the tube, the aforesaid folding and splicing zone associated with the retracted edge 6 adopts a deformed, double notch configuration (Figures 1A-4) to define, on the inside, a recessed zone "R" designed to receive the protruding lateral border 5 of the inside layer 4 and, on the outside, a relief feature designed to be substantially aligned with the retracted edge 6 of the outside layer 2. Figures 5-8 show a second embodiment of the tube 1 according to the invention.

[0053] This embodiment differs from the embodiment of Figures 1-4 in that the multilayer material 100 is obtained by folding a single sheet or web 50 about the two fold lines "P1", "P2" in such a way that the layers 2, 3, 4 follow each other along a spiral path. In this situation, the outer layers 2, 4 correspond to a first longitudinal outer area and to a longitudinal, central area of the sheet or web 50, respectively, whilst the intermediate layer 3 corresponds to a second longitudinal outer area of the sheet or web 50.

[0054] The intermediate layer 3 is smaller in width than the outer layers 2, 4 so that the free inner edge 7 of the central layer is spaced from the fold line "P2" between the outer layers 2, 4 (that is to say, from the corresponding lateral edge 120 of the three-layer material 100) to allow making a recessed zone "R" of a first of the outer layers 2, 4, where the latter has, on the side opposite to the recessed zone "R" a protruding lateral border 5 intended to be coupled to the recessed zone "R" to define an element for joining the opposite lateral edges 110, 120 of the multilayer material 100 so as to circumferentially

close the tube 1.

[0055] As shown more clearly in Figure 7, the retracted edge 7, thanks to its distance from the respective folding zone, defines a cavity 8 which is interposed between the two outer layers 2, 4. The cavity 8 defines a flattening zone where one of the two outer layers 2, 4 is deformed to create the recessed zone "R".

[0056] In the embodiment illustrated in Figures 5-8, the recessed zone "R" and the protruding lateral border 5 are defined on the outside layer 2 of the tube 1. Under the protruding lateral border 5, the two folding zones of the other two layers 3, 4 are disposed close together or in abutment to enable closing the tube 1.

[0057] The embodiment of Figures 9-12 differs from the embodiment of figures 5-8 in that the recessed zone "R" and the protruding lateral border 5 are defined on the inside layer 4 of the tube 1. On the outer side of the protruding lateral border 5, the two folding zones of the other two layers 2, 3 are disposed close together or in abutment to enable closing the tube 1.

[0058] In all the embodiments illustrated, the layers 2, 3, 4 are connected to each other by adhesive, preferably by an uninterrupted intermediate layer of adhesive or, alternatively, according to a specific, predetermined pattern. The adhesive may be the same adhesive as that used to fix the protruding lateral border 5 or it may be a different type of adhesive.

[0059] Figure 13 shows a schematic view of a portion of a machine used for making the tube 1 and, specifically, for making the three-layer material 100.

[0060] The machine initially comprises a scoring tool 200 defined in particular by a pair of opposed rollers, at least one of which is provided with a pair of discs or ridges 210 which are axially spaced from each other to make corresponding parallel lines of weakness "L1", "L2" on the initial web 50.

[0061] Obviously, the number of discs or ridges 210 depends on the number of lines of weakness to be made and hence on the number of layers of the multilayer material to be obtained and may therefore be different from two, as in the embodiments shown in the accompanying drawings.

[0062] Downstream of the scoring tool 200, the machine comprises two laminating or folding elements 300, 400, each of which is intended to fold the web 50 along a corresponding fold line coinciding with one of the aforementioned lines of weakness "L1", "L2". The two folding elements 300, 400 are disposed one after the other to make successive folds on the web 50.

[0063] More specifically, each folding element 300, 400 has a rigid structure comprising a thin plate lying in a plane parallel to the web 50 so as to be interposed between two adjacent layers being formed. Looking in more detail, each folding element 300, 400 has a shelf-like structure, supported on one side and having a suspended portion defining a respective folding edge 310, 410 intended to be exactly superposed on the respective fold line to define a laminator for folding the web 50.

[0064] When necessary, each folding element 300, 400 may be associated with a corresponding fixed diverter for progressively flattening a longitudinal area of the web 50 over an adjacent longitudinal area while folding the web 50 around the fold lines.

[0065] Advantageously, the position and structure of the scoring tool 200 is determined in such a way as to make the lines of weakness "L1", "L2" (hence the fold lines) at the desired position, specifically in such a way as to make both the protruding lateral border of one of the two outer layers and the retracted edge of the inner layer.

[0066] The present invention achieves the preset aims, overcoming the disadvantages of the prior art.

[0067] Making a multilayer tube by folding a single sheet or web two or more times along parallel fold lines allows increasing the speed and precision of production and at once maximizing the quality of the tube thus made.

[0068] Also, making all the lines of weakness on the web using a single scoring tool allows planning the lines of weakness in advance according to an extremely precise predetermined geometry repeatable over time.

Claims

1. A multilayer tube of the tobacco industry, which has an internally hollow cylindrical shape extending round a longitudinal axis (X) and whose cross section transverse to the longitudinal axis (X) has a multilayer thickness defined by at least three superposed layers (2, 3, 4), **characterized in that** it is obtained by winding a flat multilayer material (100) around the longitudinal axis (X) until juxtaposing and coupling to each other opposite lateral edges (110, 120) of the flat multilayer material (100), wherein the flat multilayer material (100) is obtained by folding a single sheet or web (50) about at least two fold lines (P1, P2) parallel to the longitudinal axis (X) to superpose corresponding longitudinal zones of the sheet or web (50) and define the multilayer thickness.
2. The tube according to claim 1, wherein the superposed layers (2, 3, 4) extend along concentric paths and wherein mutually adjacent layers (2, 3, 4) of the multilayer thickness are joined together along a folding zone extending parallel to the longitudinal axis (X) and integral with the adjacent layers (2, 3, 4) in such a way that each layer (2, 3, 4) constitutes an extension of at least one adjacent layer (2, 3, 4).
3. The tube according to claim 2, wherein the concentric paths are defined by respective cylindrical surfaces of each layer (2, 3, 4), the tube being, specifically, obtained by winding the flat multilayer material (100) around the longitudinal axis (X) in such a way that mutually juxtaposing and coupling the opposite lateral edges (110, 120) of the flat multilayer material

(100) causes each layer (2, 3, 4) to lie on a respective closed cylindrical positioning surface, the cylindrical positioning surfaces of the layer (2, 3, 4) being concentric about the longitudinal axis (X).

4. The tube according to any one of the preceding claims, wherein the sheet or web (50) has a single layer configuration and is made preferably of paper material.
5. The tube according to any one of the preceding claims, wherein one of the layers (2, 3, 4) has, along a first lateral edge (110, 120) of the multilayer web (100), a lateral border (5) protruding from an adjacent layer (2, 3, 4), the protruding lateral border (5) defining an element for joining the opposite lateral edges (110, 120) of the multilayer material (100) so as to circumferentially close the tube (1).
6. The tube according to claim 5, wherein the multilayer web (100) is provided, on its second lateral edge (110, 120) opposite to and facing the first lateral edge (110, 120), with a recess corresponding to the protruding lateral border (5) so that the protruding lateral border (5) is positioned in the recess, giving the tube a smooth, crease-free circular configuration at the zone where the lateral edges (110, 120) are spliced.
7. The tube according to claim 5 or 6, wherein the protruding lateral border (5) defining the joining element has a single layer configuration and is defined by an extension of only one of the layers (2, 3, 4).
8. The tube according to any of the preceding claims, wherein the multilayer material (100) is obtained by folding a single sheet or web (50) about the parallel fold lines (P1, P2) in such a way that the layers (2, 3, 4) follow each other along an S-shaped path, where the outer layers (2, 4) correspond to outer longitudinal areas of the sheet or web (50), while at least one intermediate layer (3) corresponds to a central longitudinal area of the sheet or web (50).
9. The tube according to claim 8, wherein a first of the outer layers (2, 4) is larger in width than the intermediate layer (3) to define a protruding lateral border (5) defining an element for joining the opposite lateral edges (110, 120) of the multilayer material (100) so as to circumferentially close the tube (1).
10. The tube according to claim 9, wherein the second outer layer (2, 4) is smaller in width than the intermediate layer (3) and defines a retracted edge (6) behind a folding and splicing zone between the other two layers (2, 3, 4), and wherein the folding and splicing zone adopts, in the tube (1), a deformed, double notch configuration to define, on one side, a recessed zone (R) designed to receive the protruding

lateral border (5) of the first outer layer (2, 4) and, on the other side, a relief feature designed to be substantially aligned with the retracted edge (6) of the second outer layer (2, 4).

11. The tube according to any of preceding claims 1 to 7, wherein the multilayer material (100) is obtained by folding a single sheet or web (50) about the parallel fold lines (P1, P2) in such a way that the layers (2, 3, 4) follow each other along a spiral path, where the outer layers (2, 4) correspond, respectively, to a first outer longitudinal area and a central longitudinal area of the sheet or web (50), while at least one intermediate layer (3) corresponds to a second outer longitudinal area of the sheet or web (50).
12. The tube according to claim 11, wherein the at least one intermediate layer (3) is smaller in width than the outer layers (2, 4) so that the free inner edge (7) of the intermediate layer (3) is spaced from the fold line between the outer layers (2, 4) to define a recessed zone (R) of a first of the outer layers (2, 4); the first outer layer (2, 4) having, on the side opposite to the recessed zone (R), a protruding lateral border (5) coupled to the recessed zone (R) of the first layer (2, 4) to define an element for joining the opposite lateral edges (110, 120) of the multilayer material (100) so as to circumferentially close the tube (1).
13. The tube according to any one of the preceding claims, wherein the superposed layers (2, 3, 4) are connected to each other by adhesive, preferably by at least one uninterrupted intermediate layer of adhesive and, still more preferably, by an intermediate layer of adhesive for each pair of adjacent layers (2, 3, 4).
14. A method for making a multilayer tube of the tobacco industry, comprising the steps of:
 - feeding a continuous web (50) along a feed direction;
 - folding the continuous web (50) on itself about at least a first longitudinal fold line (P1, P2), parallel to the feed direction, while the continuous web (50) is being fed, until obtaining a multilayer web (100) defined by superposing at least a first longitudinal area and a second longitudinal area of the continuous web (50);
 - winding the multilayer web (100) around a longitudinal axis (X) parallel to the feed direction until mutually juxtaposing opposite lateral edges (110, 120) of the multilayer web (100);
 - stably connecting the opposite lateral edges (110, 120) of the multilayer web (100) to each other;

characterized in that the step of folding the contin-

uous web (50) is accomplished by folding the web (50) a first time about a first longitudinal fold line (P1) and then folding the web (50) again about a second longitudinal fold line (P2) in such a way as to obtain an at least three-layer web (100), the fold lines (P1, P2) being parallel to each other and parallel to the feed direction of the continuous web.

15. The method according to claim 14, wherein the step of folding is accomplished by folding the web (50) around at least one folding element (300, 400), preferably a thin, longitudinal plate, so that the at least one fold line (P1, P2) is located at a respective longitudinal edge (310, 410) of the at least one folding element (300, 400).
16. The method according to claim 14 or 15, wherein the step of folding is preceded by a step of making at least one longitudinal line of weakness (L1, L2) to coincide with a respective longitudinal fold line (P1, P2) during the step of folding.
17. The method according to claim 16, wherein the step of folding the continuous web (50) is accomplished by folding the web (50) on itself about at least two parallel longitudinal fold lines (P1, P2) to define at least one three-layer web (100), and wherein the step of making at least one longitudinal line of weakness (L1, L2) is carried out by making at least two longitudinal lines of weakness (L1, L2) using a single scoring tool (200), specifically a scoring roller having at least two discs or ridges (210) which are axially spaced from each other to make corresponding parallel lines of weakness (L1, L2) on the web (50).
18. The method according to claim 17, wherein the step of folding the web (50) is accomplished by folding the web (50) about the at least two fold lines (P1, P2) in such a way that a central area of the web (50) lying between the two fold lines (P1, P2) defines an intermediate layer (3) of the three-layer web (100) while the remaining longitudinal areas of the web (50), which are on the outer sides of the two fold lines (P1, P2), define the outer layers (2, 4) of the at least three-layer web (100), and wherein the layers (2, 3, 4) of the at least three-layer web (100) follow each other along an S-shaped path.
19. The method according to claim 18, wherein a first of the outer layers (2, 4) of the at least three-layer web (100) is larger in width than the intermediate layer (3) to define a protruding lateral border (5) defining an element for joining the opposite lateral edges (110, 120) of the at least three-layer web (100) so as to circumferentially close the tube (1).
20. The method according to claim 19, wherein the second outer layer (2, 4) is smaller in width than the

intermediate layer (3) and defines a retracted edge (6) behind a folding and splicing zone between the other two layers (2, 3, 4), and wherein the step of winding the multilayer web (100) around the axis (X) includes a step of deforming the folding and splicing zone in such a way as to obtain a deformed, double notch configuration to define, on one side, a recessed zone (R) designed to receive the protruding lateral border (5) of the first outer layer (2, 4) and, on the other side, a relief feature designed to be aligned with the retracted edge (6) of the second outer layer (2, 4).

21. The method according to claim 17, wherein the step of folding the web (50) is accomplished by folding the web (50) about the fold lines (P1, P2) in such a way that the outer layers (2, 4) of the at least three-layer web (100) correspond, respectively, to a first outer longitudinal area and a central longitudinal area of the web (50), while the at least one intermediate layer (3) corresponds to a second outer longitudinal area of the web (50), and wherein the layers (2, 3, 4) of the at least three-layer web (100) follow each other along a spiral path.
22. The method according to claim 21, wherein the at least one intermediate layer (3) is smaller in width than the outer layers (2, 4) so that the free inner edge (7) of the intermediate layer (3) is spaced from the folding and splicing line between the outer layers (2, 4) to define a cavity (8) and wherein the step of winding the multilayer web (100) around the axis (X) includes a step of deforming the at least three-layer web (100) at the cavity (8) by flattening to obtain a recessed zone (R); the first outer layer (2, 4) having, on the side opposite to the recessed zone (R), a protruding lateral border (5) coupled to the recessed zone (R) to define an element for joining the opposite lateral edges (110, 120) of the at least three-layer material (100) so as to circumferentially close the tube (1).
23. The method according to any one of claims 14 to 22, wherein the step of folding the continuous web (50) on itself about at least a first longitudinal fold line (P1, P2) is associated with a step of applying adhesive between adjacent layers (2, 3, 4) of the multilayer web (100), preferably at least one uninterrupted intermediate layer of adhesive and, still more preferably, a layer of adhesive for each pair of adjacent layers (2, 3, 4).

Patentansprüche

1. Mehrschichtiges Rohr der tabakverarbeitenden Industrie, das eine innenseitig hohle zylindrische Form aufweist, sich erstreckend rund um eine Längsachse

- (X), und dessen Querschnitt quer zur Längsachse (X) eine mehrschichtige Dicke aufweist, die durch mindestens drei übereinandergelagerte Schichten (2, 3, 4) definiert ist, **dadurch gekennzeichnet, dass** es erhalten wird, indem ein flaches mehrschichtiges Material (100) rund um die Längsachse gewickelt wird, bis entgegengesetzte seitliche Kanten (110, 120) des flachen mehrschichtigen Materials (100) nebeneinander angeordnet und miteinander gekuppelt sind, wobei das flache mehrschichtige Material (100) durch Falten einer einzigen Folie oder Bahn (50) um mindestens zwei Faltlinien (P1, P2) erhalten wird, die parallel zur Längsachse (X) verlaufen, um entsprechende Längszonen der Folie oder Bahn (50) übereinanderzulagern und die mehrschichtige Dicke zu definieren.
2. Rohr nach Anspruch 1, wobei sich die übereinandergelagerten Schichten (2, 3, 4) entlang konzentrischer Wege erstrecken und wobei gegenseitig angrenzende Schichten (2, 3, 4) der mehrschichtigen Dicke entlang einer Faltzone zusammengefügt sind, die sich parallel zur Längsachse (X) erstreckt und in einem Stück mit den angrenzenden Schichten (2, 3, 4) ausgebildet ist, sodass eine jede Schicht (2, 3, 4) eine Ausdehnung von mindestens einer angrenzenden Schicht (2, 3, 4) darstellt.
 3. Rohr nach Anspruch 2, wobei die konzentrischen Wege durch jeweilige zylindrische Oberflächen einer jeden Schicht (2, 3, 4) definiert sind, wobei das Rohr insbesondere durch Wickeln des flachen mehrschichtigen Materials (100) rund um die Längsachse (X) erhalten wird, sodass das Nebeneinanderordnen und Koppeln der entgegengesetzten seitlichen Kanten (110, 120) des flachen mehrschichtigen Materials (100) bewirkt, dass eine jede Schicht (2, 3, 4) auf einer jeweiligen geschlossenen zylindrischen Positionierungsoberfläche liegt, wobei die zylindrische Positionierungsoberflächen der Schicht (2, 3, 4) konzentrisch um die Längsachse (X) angeordnet sind.
 4. Rohr nach einem der vorhergehenden Ansprüche, wobei die Folie oder die Bahn (50) eine einschichtige Auslegung aufweist und vorzugsweise aus Papiermaterial besteht.
 5. Rohr nach einem der vorhergehenden Ansprüche, wobei eine der Schichten (2, 3, 4) entlang einer ersten seitlichen Kante (110, 120) der mehrschichtigen Bahn (100) einen seitlichen Rand (5) aufweist, der aus einer angrenzenden Schicht (2, 3, 4) hervorsticht, wobei der hervorstehende seitliche Rand (5) ein Element zum Zusammenfügen der entgegengesetzten seitlichen Kanten (110, 120) des mehrschichtigen Materials (100) definiert, sodass das Rohr (1) umfangseitig geschlossen ist.
 6. Rohr nach Anspruch 5, wobei die mehrschichtige Bahn (100) auf ihrer zweiten seitlichen Kante (110, 120), die gegenständig zur ersten seitlichen Kante (110, 120) und dieser zugewandt angeordnet ist, mit einer Ausnehmung versehen ist, die passend zum hervorstehenden seitlichen Rand (5) ausgebildet ist, sodass der hervorstehende seitliche Rand (5) in der Ausnehmung positioniert ist und dem Rohr eine glatte, knickfreie kreisförmige Auslegung an der Zone, an der die seitlichen Kanten (110, 120) verspleißt sind, verleiht.
 7. Rohr nach Anspruch 5 oder 6, wobei der hervorstehende seitliche Rand (5), der das Zusammenfügeelement definiert, eine einschichtige Auslegung aufweist und durch eine Ausdehnung von nur einer der Schichten (2, 3, 4) definiert ist.
 8. Rohr nach einem der vorhergehenden Ansprüche, wobei das mehrschichtige Material (100) erhalten wird, indem eine einzelne Folie oder Bahn (50) um die parallelen Faltlinien (P1, P2) gefaltet wird, sodass die Schichten (2, 3, 4) entlang eines S-förmigen Wegs aufeinanderfolgen, wobei die äußeren Schichten (2, 4) den äußeren Längsbereichen der Folie oder Bahn (50) entsprechen, während mindestens eine Zwischenschicht (3) einem zentralen Längsbereich der Folie oder Bahn (50) entspricht.
 9. Rohr nach Anspruch 8, wobei eine erste der äußeren Schichten (2, 4) breiter ist als die Zwischenschicht (3), um einen hervorstehenden seitlichen Rand (5) zu definieren, der ein Element definiert, um die entgegengesetzten seitlichen Kanten (110, 120) des mehrschichtigen Materials (100) zusammenzufügen, sodass das Rohr (1) umfangseitig geschlossen ist.
 10. Rohr nach Anspruch 9, wobei die zweite äußere Schicht (2, 4) schmaler ist als die Zwischenschicht (3) und eine eingezogene Kante (6) hinter einer Falt- und Spleißzone zwischen den anderen beiden Schichten (2, 3, 4) definiert, und wobei die Falt- und Spleißzone im Rohr (1) eine verformte Doppelkerbenauslegung einnimmt, um auf einer Seite eine vertiefte Zone (R) zu definieren, die ausgestaltet ist, um den hervorstehenden seitlichen Rand (5) der ersten äußeren Schicht (2, 4) aufzunehmen, und auf der anderen Seite ein erhabenes Teil, das ausgestaltet ist, um im Wesentlichen fluchtend zur eingezogenen Kante (6) der zweiten äußeren Schicht (2, 4) angeordnet zu sein.
 11. Rohr nach einem der Ansprüche 1 bis 7, wobei das mehrschichtige Material (100) erhalten wird, indem eine einzelne Folie oder Bahn (50) um die parallelen Faltlinien (P1, P2) gefaltet wird, sodass die Schichten (2, 3, 4) entlang eines spiralförmigen Wegs auf-

- einanderfolgen, wobei die äußeren Schichten (2, 4) jeweils einem ersten äußeren Längsbereich und einem zentralen Längsbereich der Folie oder Bahn (50) entsprechen, während mindestens eine Zwischenschicht (3) einem zweiten äußeren Längsbereich der Folie oder Bahn (50) entspricht.
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12. Rohr nach Anspruch 11, wobei die mindestens eine Zwischenschicht (3) schmaler ist als die äußeren Schichten (2, 4), sodass die freie innere Kante (7) der Zwischenschicht (3) von der Faltlinie zwischen den äußeren Schichten (2, 4) beabstandet ist, um eine vertiefte Zone (R) einer ersten der äußeren Schichten (2, 4) zu definieren, wobei die erste äußere Schicht (2, 4) auf der der vertieften Zone (R) entgegengesetzten Seite einen hervorstehenden seitlichen Rand (5) aufweist, der mit der vertieften Zone (R) der ersten Schicht (2, 4) gekoppelt ist, um ein Element zum Zusammenfügen der entgegengesetzten seitlichen Kanten (110, 120) des mehrschichtigen Materials (100) zu definieren, sodass das Rohr (1) umfangseitig geschlossen ist.
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13. Rohr nach einem der vorhergehenden Ansprüche, wobei die übereinandergelagerten Schichten (2, 3, 4) miteinander durch Klebstoff verbunden sind, vorzugsweise durch mindestens eine ununterbrochene Zwischenschicht aus Klebstoff und noch bevorzugter durch eine Zwischenschicht aus Klebstoff für ein jedes Paar angrenzender Schichten (2, 3, 4).
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14. Verfahren zur Herstellung eines mehrschichtigen Rohrs der tabakverarbeitenden Industrie, umfassend die folgenden Schritte:
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- Zuführen einer durchgehenden Bahn (50) entlang einer Zuführungsrichtung;
 - Falten der durchgehenden Bahn (50) um sich selbst um mindestens eine erste Längsfaltlinie (P1, P2) parallel zur Zuführungsrichtung, während die durchgehende Bahn (50) zugeführt wird, bis eine mehrschichtige Bahn (100) erhalten wird, die durch Übereinanderlagern von mindestens einem ersten Längsbereich und einem zweiten Längsbereich der durchgehenden Bahn (50) definiert ist;
 - Wickeln der mehrschichtigen Bahn (100) rund um eine Längsachse (X) parallel zur Zuführungsrichtung, bis entgegengesetzte seitliche Kanten (110, 120) der mehrschichtigen Bahn (100) nebeneinander angeordnet sind;
 - stabiles Verbinden der entgegengesetzten seitlichen Kanten (110, 120) der mehrschichtigen Bahn (100) miteinander,
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- dadurch gekennzeichnet, dass der Schritt zum Falten der durchgehenden Bahn (50) durchgeführt wird, indem die Bahn (50) ein erstes Mal um eine
- erste Längsfaltlinie (P1) gefaltet wird und die Bahn (50) dann erneut um eine zweite Längsfaltlinie (P2) gefaltet wird, sodass eine mindestens dreischichtige Bahn (100) erhalten wird, wobei die Faltlinien (P1, P2) parallel zueinander und parallel zur Zuführungsrichtung der durchgehenden Bahn angeordnet sind.
15. Verfahren nach Anspruch 14, wobei der Schritt zum Falten durchgeführt wird, indem die Bahn (50) rund um mindestens ein Faltelement (300, 400) gefaltet wird, bei dem es sich vorzugsweise um eine dünne Längsplatte handelt, sodass die mindestens eine Faltlinie (P1, P2) an einer jeweiligen Längskante (310, 410) des mindestens einen Faltelements (300, 400) platziert ist.
16. Verfahren nach Anspruch 14 oder 15, wobei vor dem Schritt zum Falten ein Schritt zum Herstellen von mindestens einer Längsschwächungslinie (L1, L2) erfolgt, um mit einer jeweiligen Längsfaltlinie (P1, P2) während des Schritts zum Falten übereinzustimmen.
17. Verfahren nach Anspruch 16, wobei der Schritt zum Falten der durchgehenden Bahn (50) durch Falten der Bahn (50) um sich selbst um mindestens zwei parallele Längsfaltlinien (P1, P2) erfolgt, um mindestens eine dreischichtige Bahn (100) zu definieren, wobei der Schritt zum Herstellen von mindestens einer Längsschwächungslinie (L1, L2) durchgeführt wird, indem mindestens zwei Längsschwächungslinien (L1, L2) unter Nutzung eines einzelnen Rillwerkzeugs (200), insbesondere einer Rillwalze, ausgebildet werden, aufweisend mindestens zwei Scheiben oder Rippen (210), die axial voneinander beabstandet sind, um entsprechende parallele Schwächungslinien (L1, L2) auf der Bahn (50) auszubilden.
18. Verfahren nach Anspruch 17, wobei der Schritt zum Falten der Bahn (50) durchgeführt wird, indem die Bahn (50) um mindestens zwei Faltlinien (P1, P2) gefaltet wird, sodass ein zentraler Bereich der Bahn (50), der zwischen den beiden Faltlinien (P1, P2) liegt, eine Zwischenschicht (3) der dreischichtigen Bahn (100) definiert, während die verbleibenden Längsbereiche der Bahn (50), die sich auf den äußeren Seiten der beiden Faltlinien (P1, P2) befinden, die äußeren Schichten (2, 4) der mindestens dreischichtigen Bahn (100) definieren, und wobei die Schichten (2, 3, 4) der mindestens dreischichtigen Bahn (100) jeweils entlang eines S-förmigen Wegs aufeinanderfolgen.
19. Verfahren nach Anspruch 18, wobei eine erste der äußeren Schichten (2, 4) der mindestens dreischichtigen Bahn (100) breiter ist als die Zwischenschicht (3), um einen hervorstehenden seitlichen Rand (5) zu definieren, definierend ein Element zum Zusammen-
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menfügen der entgegengesetzten seitlichen Kanten (110, 120) der mindestens dreischichtigen Bahn (100), sodass das Rohr (1) umfangseitig geschlossen ist.

20. Verfahren nach Anspruch 19, wobei die zweite äußere Schicht (2, 4) schmaler ist als die Zwischenschicht (3) und eine eingezogene Kante (6) hinter einer Falt- und Spleißzone zwischen den anderen beiden Schichten (2, 3, 4) definiert, und wobei der Schritt zum Wickeln der mehrschichtigen Bahn (100) rund um die Achse (X) einen Schritt zum Verformen der Falt- und Spleißzone einschließt, sodass eine verformte Doppelkerbenauslegung erhalten wird, um auf einer Seite eine vertiefte Zone (R) zu definieren, die ausgestaltet ist, um den hervorstehenden seitlichen Rand (5) der ersten äußeren Schicht (2, 4) aufzunehmen, und auf der anderen Seite ein erhabenes Teil, das ausgestaltet ist, um fluchtend zur eingezogenen Kante (6) der zweiten äußeren Schicht (2, 4) angeordnet zu sein.
21. Verfahren nach Anspruch 17, wobei der Schritt zum Falten der Bahn (50) durchgeführt wird, indem die Bahn (50) um die Faltlinien (P1, P2) gefaltet wird, sodass die äußeren Schichten (2, 4) der mindestens dreischichtigen Bahn (100) jeweils einem ersten äußeren Längsbereich und einem zentralen Längsbereich der Bahn (50) entsprechen, während die mindestens eine Zwischenschicht (3) einem zweiten äußeren Längsbereich der Bahn (50) entspricht, und wobei die Schichten (2, 3, 4) der mindestens dreischichtigen Bahn (100) entlang eines spiralförmigen Wegs aufeinanderfolgen.
22. Verfahren nach Anspruch 21, wobei die mindestens eine Zwischenschicht (3) schmaler ist als die äußeren Schichten (2, 4), sodass die freie innere Kante (7) der Zwischenschicht (3) von der Falt- und Spleißlinie zwischen den äußeren Schichten (2, 4) beabstandet ist, um einen Hohlraum (8) zu definieren, und wobei der Schritt zum Wickeln der mehrschichtigen Bahn (100) rund um die Achse (X) einen Schritt zum Verformen der mindestens dreischichtigen Bahn (100) am Hohlraum (8) durch Abflachen einschließt, um eine vertiefte Zone (R) zu erhalten, wobei die erste äußere Schicht (2, 4) auf der der vertieften Zone (R) entgegengesetzten Seite einen vorstehenden seitlichen Rand (5) aufweist, der mit der vertieften Zone (R) gekoppelt ist, um ein Element zum Zusammenfügen der entgegengesetzten seitlichen Kanten (110, 120) des mindestens dreischichtigen Materials (100) zu definieren, sodass das Rohr (1) umfangseitig geschlossen ist.
23. Verfahren nach einem der Ansprüche 14 bis 22, wobei der Schritt zum Falten der durchgehenden Bahn (50) um sich selbst um mindestens eine erste Längs-

faltlinie (P1, P2) mit einem Schritt zum Auftragen von Klebstoff zwischen angrenzenden Schichten (2, 3, 4) der mehrschichtigen Bahn (100) assoziiert ist, wobei es sich vorzugsweise um mindestens eine ununterbrochene Zwischenschicht aus Klebstoff und noch bevorzugter eine Schicht aus Klebstoff für ein jedes Paar angrenzender Schichten (2, 3, 4) handelt.

10 Revendications

1. Tube multicouche de l'industrie du tabac, ayant une forme cylindrique intérieurement creuse se prolongeant autour d'un axe longitudinal (X) et dont la section transversale transverse à l'axe longitudinal (X) possède une épaisseur multicouche définie par au moins trois couches superposées (2, 3, 4), **caractérisé en ce qu'il** est obtenu par enroulement d'un matériau multicouche plat (100) autour de l'axe longitudinal (X) jusqu'à juxtaposition et couplage l'un à l'autre des bords latéraux opposés (110, 120) du matériau multicouche plat (100), dans lequel le matériau multicouche plat (100) est obtenu en pliant une seule feuille ou bande (50) autour d'au moins deux lignes de pliage (P1, P2) parallèles à l'axe longitudinal (X) pour superposer des zones longitudinales correspondantes de la feuille ou de la bande (50) et définir l'épaisseur multicouche.
2. Tube selon la revendication 1, dans lequel les couches superposées (2, 3, 4) se prolongent le long de trajectoires concentriques et dans lequel les couches mutuellement adjacentes (2, 3, 4) de l'épaisseur multicouche sont assemblées le long d'une zone de pliage se prolongeant parallèlement à l'axe longitudinal (X) et sont solidaires des couches adjacentes (2, 3, 4) de telle sorte que chaque couche (2, 3, 4) constitue une extension d'au moins une couche adjacente (2, 3, 4).
3. Tube selon la revendication 2, dans lequel les trajectoires concentriques sont définies par des surfaces cylindriques respectives de chaque couche (2, 3, 4), le tube étant, en particulier, obtenu en enroulant le matériau multicouche plat (100) autour de l'axe longitudinal (X) de telle sorte que la juxtaposition et le couplage mutuels des bords latéraux opposés (110, 120) du matériau multicouche plat (100) amènent chaque couche (2, 3, 4) à reposer sur une surface de positionnement cylindrique fermée respective, les surfaces de positionnement cylindriques de la couche (2, 3, 4) étant concentriques autour de l'axe longitudinal (X).
4. Tube selon l'une quelconque des revendications précédentes, dans lequel la feuille ou la bande (50) possède une configuration à une seule couche et est fabriquée de préférence en papier.

5. Tube selon l'une quelconque des revendications précédentes, dans lequel l'une des couches (2, 3, 4) comporte, le long d'un premier bord latéral (110, 120) de la bande multicouche (100), une bordure latérale (5) dépassant d'une couche adjacente (2, 3, 4), la bordure latérale en saillie (5) définissant un élément permettant de joindre les bords latéraux opposés (110, 120) du matériau multicouche (100) de manière à fermer le tube (1) de manière circonferentielle.
6. Tube selon la revendication 5, dans lequel la bande multicouche (100) est pourvue, sur son deuxième bord latéral (110, 120) opposé et faisant face au premier bord latéral (110, 120), d'un renforcement correspondant à la bordure latérale en saillie (5) de sorte que la bordure latérale en saillie (5) est positionnée dans le renforcement, donnant au tube une configuration circulaire lisse et sans plis en correspondance de la zone où les bords latéraux (110, 120) sont joints.
7. Tube selon la revendication 5 ou 6, dans lequel la bordure latérale en saillie (5) définissant l'élément de jonction possède une configuration à une seule couche et est défini par une extension d'une seule des couches (2, 3, 4).
8. Tube selon l'une quelconque des revendications précédentes, dans lequel le matériau multicouche (100) est obtenu en pliant une seule feuille ou bande (50) autour des lignes de pliage parallèles (P1, P2) de telle sorte que les couches (2, 3, 4) se suivent le long d'une trajectoire en forme de « S », où les couches extérieures (2, 4) correspondent à des zones longitudinales extérieures de la feuille ou de la bande (50), tandis qu'au moins une couche intermédiaire (3) correspond à une zone longitudinale centrale de la feuille ou de la bande (50).
9. Tube selon la revendication 8, dans lequel une première des couches extérieures (2, 4) est plus large que la couche intermédiaire (3) pour définir une bordure latérale en saillie (5) définissant un élément pour joindre les bords latéraux opposés (110, 120) du matériau multicouche (100) de manière à fermer le tube (1) de manière circonferentielle.
10. Tube selon la revendication 9, dans lequel la deuxième couche extérieure (2, 4) est moins large que la couche intermédiaire (3) et définit un bord rétracté (6) derrière une zone de pliage et de jointure entre les deux autres couches (2, 3, 4), et dans lequel la zone de pliage et de jointure adopte, dans le tube (1), une configuration déformée à double encoche pour définir, sur un côté, une zone renforcée (R) destinée à recevoir la bordure latérale en saillie (5) de la première couche extérieure (2, 4) et, sur l'autre côté, une partie en relief destinée à être essentiellement alignée au bord rétracté (6) de la deuxième couche extérieure (2, 4).
11. Tube selon l'une quelconque des revendications précédentes 1 à 7, dans lequel le matériau multicouche (100) est obtenu en pliant une seule feuille ou bande (50) autour des lignes de pliage parallèles (P1, P2) de telle sorte que les couches (2, 3, 4) se suivent le long d'une trajectoire en spirale, où les couches extérieures (2, 4) correspondent, respectivement, à une première zone longitudinale extérieure et à une zone longitudinale centrale de la feuille ou de la bande (50), tandis qu'au moins une couche intermédiaire (3) correspond à une deuxième zone longitudinale extérieure de la feuille ou de la bande (50).
12. Tube selon la revendication 11, dans lequel l'au moins une couche intermédiaire (3) est moins large que les couches extérieures (2, 4) de sorte que le bord intérieur libre (7) de la couche intermédiaire (3) est espacé de la ligne de pliage entre les couches extérieures (2, 4) pour définir une zone renforcée (R) d'une première des couches extérieures (2, 4) ; la première couche extérieure (2, 4) comporte, sur le côté opposé à la zone renforcée (R), une bordure latérale en saillie (5) couplée à la zone renforcée (R) de la première couche (2, 4) pour définir un élément permettant de joindre les bords latéraux opposés (110, 120) du matériau multicouche (100) de manière à fermer circonferentiellement le tube (1).
13. Tube selon l'une quelconque des revendications précédentes, dans lequel les couches superposées (2, 3, 4) sont reliées entre elles par un adhésif, de préférence par au moins une couche intermédiaire ininterrompue d'adhésif et, de préférence encore, par une couche intermédiaire d'adhésif pour chaque paire de couches adjacentes (2, 3, 4).
14. Procédé de fabrication d'un tube multicouche de l'industrie du tabac, comprenant les étapes de :
- alimenter une bande continue (50) le long d'une direction d'alimentation ;
 - plier la bande continue (50) sur elle-même autour d'au moins une première ligne de pliage longitudinale (P1, P2), parallèlement à la direction d'alimentation, pendant que la bande continue (50) est alimentée, jusqu'à l'obtention d'une bande multicouche (100) définie par la superposition d'au moins une première zone longitudinale et une deuxième zone longitudinale de la bande continue (50) ;
 - enrouler la bande multicouche (100) autour d'un axe longitudinal (X) parallèle à la direction d'alimentation jusqu'à juxtaposition mutuelle

des bords latéraux opposés (110, 120) de la bande multicouche (100) ;
 - relier stablement les bords latéraux opposés (110, 120) de la bande multicouche (100) l'un à l'autre ;

caractérisé en ce que l'étape de pliage de la bande continue (50) est accompli en pliant la bande (50) une première fois autour d'une première ligne de pliage longitudinale (P1), puis en pliant à nouveau la bande (50) autour d'une deuxième ligne de pliage longitudinale (P2) de manière à obtenir une bande (100) d'au moins trois couches, les lignes de pliage (P1, P2) étant parallèles entre elles et parallèles à la direction d'alimentation de la bande continue.

15. Procédé selon la revendication 14, dans lequel l'étape de pliage est accomplie en pliant la bande (50) autour d'au moins un élément de pliage (300, 400), de préférence une plaque longitudinale mince, de sorte que l'au moins une ligne de pliage (P1, P2) soit située en correspondance d'un bord longitudinal (310, 410) respectif de l'au moins un élément de pliage (300, 400).
16. Procédé selon la revendication 14 ou 15, dans lequel l'étape de pliage est précédée d'une étape consistant à réaliser au moins une ligne longitudinale de faiblesse (L1, L2) pour coïncider avec une ligne de pliage longitudinale (P1, P2) respective pendant l'étape de pliage.
17. Procédé selon la revendication 16, dans lequel l'étape de pliage de la bande continue (50) est accomplie en pliant la bande (50) sur elle-même autour d'au moins deux lignes de pliage longitudinales parallèles (P1, P2) pour définir une bande d'au moins trois couches (100), et dans lequel l'étape consistant à réaliser au moins une ligne longitudinale de faiblesse (L1, L2) est effectuée en réalisant au moins deux lignes longitudinales de faiblesse (L1, L2) à l'aide d'un seul outil raineur (200), en particulier un rouleau raineur comportant au moins deux disques ou stries (210) étant espacés axialement l'un de l'autre pour réaliser des lignes de faiblesse parallèles (L1, L2) correspondantes sur la bande (50).
18. Procédé selon la revendication 17, dans lequel l'étape de pliage de la bande (50) est accomplie en pliant la bande (50) autour des au moins deux lignes de pliage (P1, P2) de telle sorte qu'une zone centrale de la bande (50) reposant entre les deux lignes de pliage (P1, P2) définit une couche intermédiaire (3) de la bande à trois couches (100), tandis que les zones longitudinales restantes de la bande (50), qui se trouvent sur les côtés extérieurs des deux lignes de pliage (P1, P2), définissent les couches extérieures (2, 4) de la bande d'au moins trois couches (100),

et dans lequel les couches (2, 3, 4) de la bande d'au moins trois couches (100) se suivent le long d'une trajectoire en forme de « S ».

- 5 19. Procédé selon la revendication 18, dans lequel une première des couches extérieures (2, 4) de la bande d'au moins trois couches (100) est plus large que la couche intermédiaire (3) pour définir une bordure latérale en saillie (5) définissant un élément pour joindre les bords latéraux opposés (110, 120) de la bande d'au moins trois couches (100) de manière à fermer circonférentiellement le tube (1).
- 10 20. Procédé selon la revendication 19, dans lequel la deuxième couche extérieure (2, 4) est moins large que la couche intermédiaire (3) et définit un bord rétracté (6) derrière une zone de pliage et de jointure entre les deux autres couches (2, 3, 4), et dans lequel l'étape consistant à enrouler la bande multicouche (100) autour de l'axe (X) inclut une étape consistant à déformer la zone de pliage et de jointure de manière à obtenir une configuration déformée à double encoche pour définir, sur un côté, une zone renfoncée (R) destinée à recevoir la bordure latérale en saillie (5) de la première couche extérieure (2, 4) et, sur l'autre côté, une partie en relief destinée à être alignée avec le bord rétracté (6) de la deuxième couche extérieure (2, 4).
- 15 21. Procédé selon la revendication 17, dans lequel l'étape de pliage de la bande (50) est accomplie en pliant la bande (50) autour des lignes de pliage (P1, P2) de manière à ce que les couches extérieures (2, 4) de la bande d'au moins trois couches (100) correspondent, respectivement, à une première zone longitudinale extérieure et à une zone longitudinale centrale de la bande (50), tandis que l'au moins une couche intermédiaire (3) correspond à une deuxième zone longitudinale extérieure de la bande (50), et dans lequel les couches (2, 3, 4) de la bande d'au moins trois couches (100) se suivent le long d'une trajectoire en spirale.
- 20 22. Procédé selon la revendication 21, dans lequel l'au moins une couche intermédiaire (3) est moins large que les couches extérieures (2, 4) de sorte que le bord intérieur libre (7) de la couche intermédiaire (3) est espacé de la ligne de pliage et de jointure entre les couches extérieures (2, 4) pour définir une cavité (8) et dans lequel l'étape consistant à enrouler la bande multicouche (100) autour de l'axe (X) inclut une étape consistant à déformer la bande d'au moins trois couches (100) en correspondance de la cavité (8) par aplatissement pour obtenir une zone renfoncée (R) ; la première couche extérieure (2, 4) comportant, sur le côté opposé à la zone renfoncée (R), une bordure latérale en saillie (5) couplée à la zone renfoncée (R) pour définir un élément permettant de
- 25 30 35 40 45 50 55

joindre les bords latéraux opposés (110, 120) du matériau d'au moins trois couches (100) de manière à fermer circonférentiellement le tube (1).

23. Procédé selon l'une quelconque des revendications 14 à 22, dans lequel l'étape de pliage de la bande continue (50) sur elle-même autour d'au moins une première ligne de pliage longitudinale (P1, P2) est associée à une étape consistant à appliquer de l'adhésif entre les couches adjacentes (2, 3, 4) de la bande multicouche (100), de préférence au moins une couche intermédiaire ininterrompue d'adhésif et, de préférence encore, une couche d'adhésif pour chaque paire de couches adjacentes (2, 3, 4).

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Fig.1

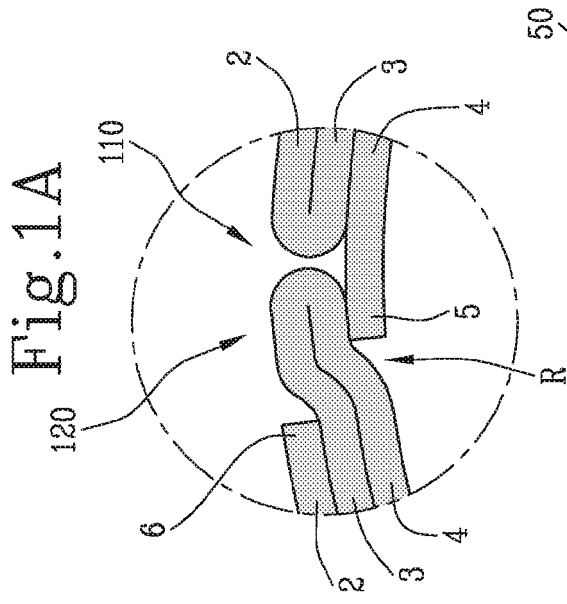
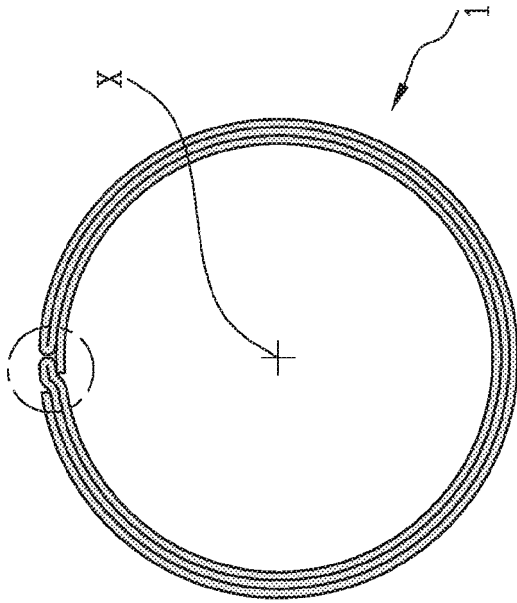


Fig.2



Fig.3

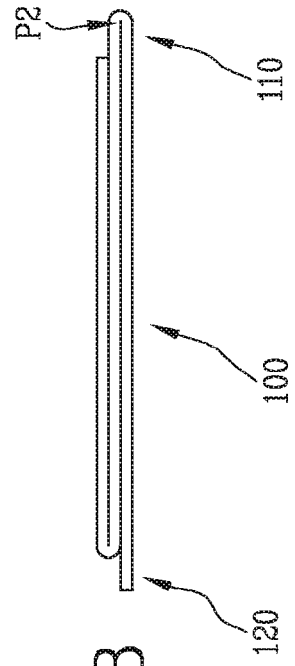
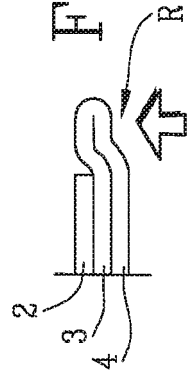


Fig.4



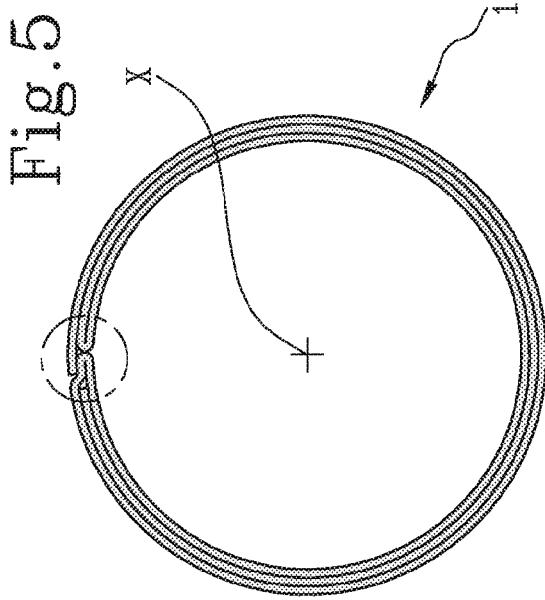


Fig. 5A

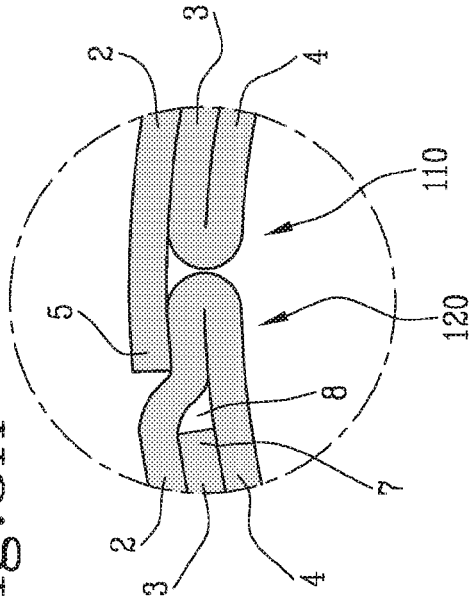


Fig. 6

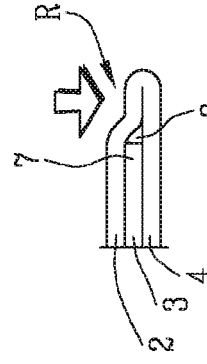


Fig. 8

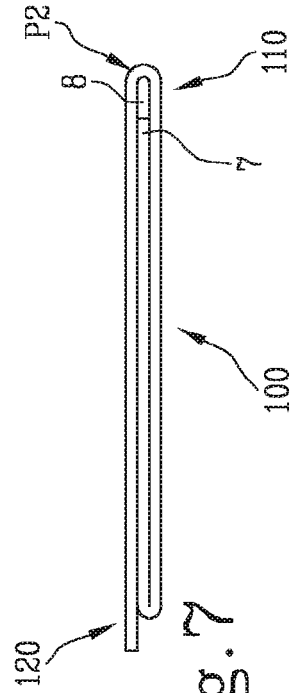


Fig. 7

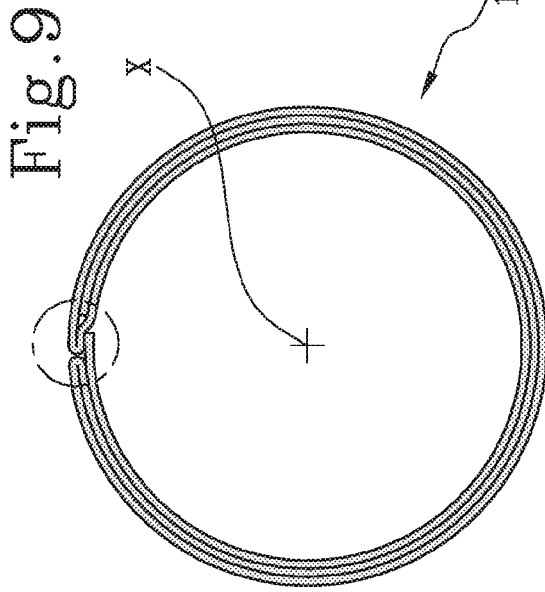


Fig. 9A

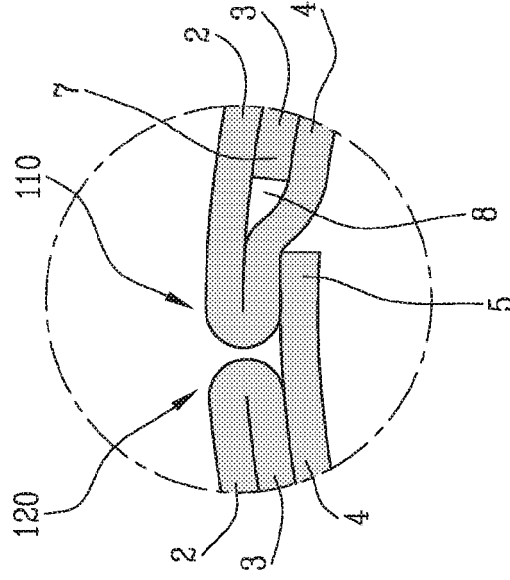


Fig. 10

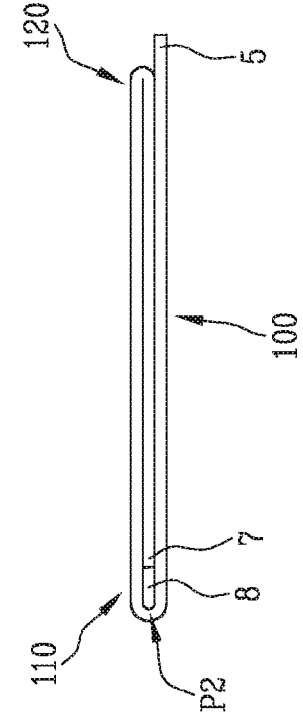


Fig. 11

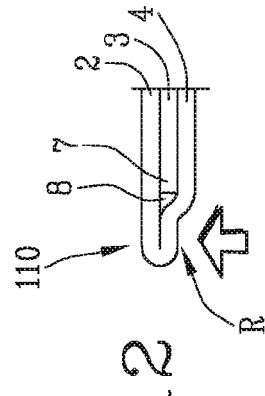
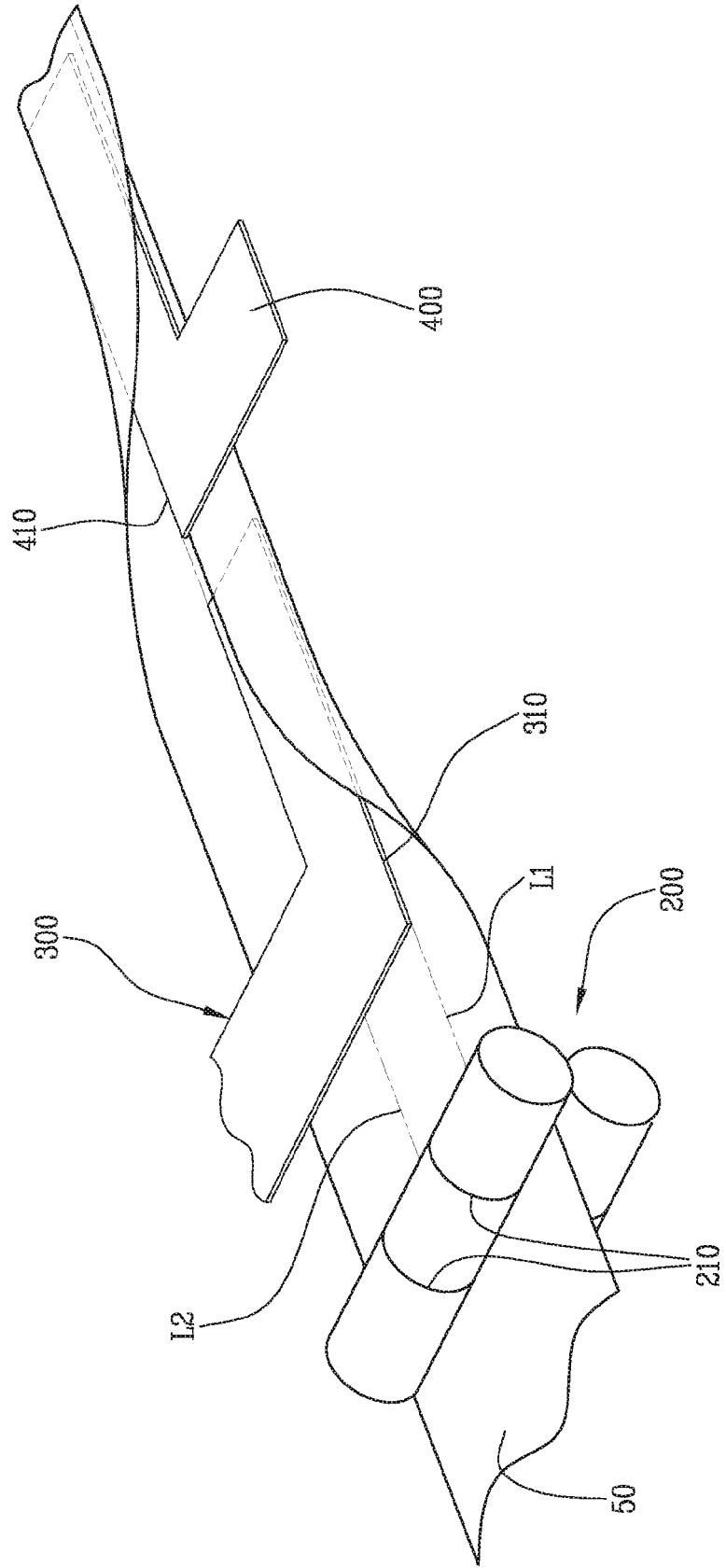


Fig. 12

Fig.13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- GB 1538452 A [0006]
- GB 1556728 A [0006]