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**(54) Machine for making a smoking article**

Maschine zur Herstellung eines Rauchartikels

Machine pour la fabrication d'un article à fumer

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## Description

### Field of the Invention

**[0001]** The present invention relates to a device for making a smoking article.

### Background to the Invention

**[0002]** "Make-Your-Own" cigarettes are popular because of the control, value and quality that assembling smoking articles gives consumers. Indeed, many users make cigarettes using machines that insert tobacco into prefabricated cigarette tubes.

**[0003]** A typical cigarette tube-filling device comprises a tobacco chamber, a nozzle at one end of the tobacco chamber, a device for clamping a cigarette tube onto the nozzle, and a means of pressing tobacco into the chamber. In use, the strand of tobacco from the chamber is typically injected into the cigarette tube by way of a user-operated sliding mechanism.

**[0004]** In spite of the machine assistance, Make-Your-Own cigarettes are inherently filled relatively sparsely with loose tobacco. This, combined with the uneven distribution of tobacco that naturally results from hand-loading tobacco of variable coarseness, gives rise to cigarettes that often have a low density of material at the open end. Smoking articles produced by current make your own devices therefore suffer from a propensity to have smoking material fall out of the open end of the article. The mess of debris and the waste of costly smoking material that result from this "end fall-out" go some way to negating the advantages of Make-Your-Own systems.

**[0005]** The issue to be solved is therefore how to provide a Make-Your-Own device for producing higher-quality smoking articles that alleviates the issue of end fall-out.

**[0006]** US 6345624 B1 discloses a cigarette making machine of the injection type wherein a supply of tobacco is compacted into cylindrical form, and is injected into a preformed cigarette tube positioned on the machine. DE 202006001708 U1 discloses a hand apparatus for filling cigarette tubes with tobacco having a clamping device, operated by a pressure surface arranged in a surface of a lid element and pressurized crosswise to a direction of displacement of a sliding part. DE 3410039 A1 discloses a method and apparatus for producing a tobacco product having a pre-metered tobacco stock which can be transferred into a prefabricated cigarette paper wrapper.

### Summary of the Invention

**[0007]** In accordance with the invention we provide a device for making a smoking article, the device comprising: a casing having an elongate structure and defining a cavity for receiving smoking material in use, the casing having an aperture for receiving a smoking article tube at an insertion end thereof, the aperture being connected

to the cavity, such that, in use smokable material within the cavity is driven into the tube so that a smoking article is created, wherein the cavity is arranged such that it has a region of increased cross-sectional area in a direction perpendicular to the direction of insertion at an end opposite to the insertion aperture.

**[0008]** Using the invention, a user may make a cigarette by firstly placing tobacco, or other smokable material, into the cavity. The user will typically then compress the material within the cavity, and slide the tube along the direction of insertion with the effect of pushing the material into the tube.

**[0009]** By providing a cavity with the above shape smoking articles produced by the device have a region of more densely packed smoking material at the open end. This "dense ending" results in the filling at the open end being less likely to fall out of the tube, thereby solving the problem of end fall-out of material. Such a region causes a user filling the cavity naturally to insert a slightly increased quantity at the end region, resulting in a denser end, since the increased material quantity at the end region is compressed within a region of the tube of substantially the same width and cross-sectional area as the remainder of the tube.

**[0010]** A device according to the invention possesses the additional advantages of being portable and conveniently operable in a handheld manner, and being easy to manufacture, with a low cost of production owing to its simple design.

**[0011]** The elongate direction or axis of the casing may be aligned with, or substantially parallel to, the direction of insertion. Such an arrangement is well-suited to accommodating elongate cigarette tubes, since it allows the volume of the device to be minimised. The convenient, handheld, portable nature of the invention in combination with its ability to produce dense ended cigarettes is a valuable advantage.

**[0012]** Typically, the insertion aperture is arranged to allow the insertion of the tube into the cavity. The insertion aperture therefore preferably has a substantially circular shape in order to accommodate the passage of cylindrical smoking articles in the direction of insertion.

**[0013]** Typically the casing comprises an opening for receiving smoking material therethrough in use. The opening will typically be connected to the cavity so as to provide the user access for filling the cavity with smokable material. Typically, in use, smokable material is placed in the cavity via the opening. Preferably, the opening is positioned along the length of the elongate casing and has length and width similar to those of the cavity. Such a placement allows a user control over the distribution of smokable material within the cavity, and provides access for the material to be compressed into the cavity. The opening being separate from the provided aperture for receiving a smoking article tube is preferable because the aperture should preferably have a size and shape configured for receiving a smoking article tube, while the opening should preferably have a size and position as

described above.

**[0014]** Typically, the device comprises a closure having a portion arranged to cover the opening and press smokable material into the cavity in use. The closure will typically be in the form of a lid attached to the device such that it may be pivoted between open and closed positions wherein the opening is uncovered and covered respectively.

**[0015]** Typically, the smokable material is pressed into the cavity using the closure by closing it such that a protruding portion of the closure projects into the opening. This arrangement allows a user to apply the necessary compression to the material with a single pressing action.

**[0016]** Additionally, the closure may be arranged to fasten the tube within the insertion aperture in use. In this way, the purchase that is required in order to push the smokable material into tube, and the compression of the material, are both provided by the same mechanism, thereby simplifying the construction of the device.

**[0017]** Preferably the portion of the closure has a shape corresponding to the shape of the opening. The pressing portion of the closure will therefore include a widening portion conforming to the shape of the end of the cavity, such that even compression is applied to the entirety of the material in the cavity. Typically, the closure may be connected to the casing by a pivot such that, in use, the closure may be moved with respect to the casing so as to open and close the opening. The inclusion of the pivot provides the advantage that the pressing of smokable material and the securing of a cigarette tube are both achieved by a repeatable, consistent action.

**[0018]** Preferably, the device further comprises a tongue for assisting the driving of smokable material within the cavity into the tube, the tongue being positioned within the cavity and arranged so as to enter the tube along with the smokable material.

**[0019]** The cavity may be arranged such that it has more than one region of increased cross-sectional area in a direction perpendicular to the direction of insertion. This provision of additional wide sections of the cavity will result in additional bands of higher density smokable material in the finished smoking article. Such an arrangement allows the creation of "lower ignition-propensity" (LIP) products as a result of the decreased rate at which the smokable material will combust within high-density bands.

#### Brief Description of the Drawings

**[0020]** Examples of the present invention will now be described, with reference to the accompanying drawings, in which:

Figure 1 is a schematic illustration showing a typical make-your-own cigarette device in several stages of use.

Figure 2 is a flow diagram illustrating an example method of using a make your own cigarette device.

Figure 3 is a schematic diagram showing an example device according to the invention including a representation of the shape of an example cavity.

Figure 4 shows an example device in accordance with the invention and the effect upon its geometry of a cavity being arranged according to the invention. Figure 5 shows the profiles of two cavities arranged according to the invention.

#### Description of Embodiments

**[0021]** Referring to Figure 1, a device for making a smoking article is shown at four stages of use (A-D). The device comprises a casing 3 having an elongate structure and defining a similarly elongate cavity 4 for receiving smokable material 7 in use. The casing has an aperture 10 for receiving a smoking article tube 11 at an insertion end 13 thereof. The cavity is connected to the insertion end 13 through the aperture 10.

**[0022]** It will be understood that although the device may be constructed such that it does not have an elongate structure overall, it will contain elongate elements, such as an inner casing or a cavity, so as to be suited to the device's function of filling tube-shaped smoking articles.

**[0023]** The opening 6 through which smokable material is received is positioned in the top of the casing, as defined by the orientation in which a user holds the device in use. This provides the user with easy access to, and visibility of the cavity, however the material may be inserted via an opening having any reasonable position. In such embodiments as those illustrated, wherein the opening is positioned in the top of the casing, a closure 8 may be connected via a pivot to the top of the device.

**[0024]** With reference to Figures 1 and 2, an example process of using a device according to the invention is as follows:

A) At 101 a user opens moveable closure 8 and at 103 places smokable material in the cavity 4.

B) The user then closes the closure at 105, causing the material to be pressed by a portion 9 of the closure into the cavity at 107. At 109 the user places a smoking article tube at the aperture.

C) The user then slides the closure back at 111 so as to slide the tube into the casing, causing smokable material within the cavity to be driven into the tube at 113 so that a smoking article 2 is created.

D) The tube is then slid back out at 115 and the finished cigarette 2 is then removed at 117 (D).

Step 109 may be performed either at stage (B) or beforehand, for example at stage (A), as depicted in the figures.

**[0025]** It can be seen that the portion 9 arranged to cover the opening and press into the cavity has the form of a bar attached to the closure 8. The bar is arranged such that, when the closure pivots about its hinge, the bar rotates within a plane aligned with the direction of

insertion and/or the casing's elongate axis. It can be seen that the face of the bar that is arranged to press against the smokable material has a concave curve around an axis parallel to the direction of insertion. The curve conforms to the cylindrical shape of the smoking article tube, however it may have any other shape, including being substantially flat.

**[0026]** The portion may have a size and shape that allows all parts of the pressing face to extend into the cavity to a substantially equal degree. A user could therefore apply even compression to the entire area of smokable material within the cavity by applying a single pressing action to the closure, resulting in the smoking article being filled with improved uniformity.

**[0027]** The closure 8 has a gripping region 12 arranged to fasten a smoking article tube to aperture 10 when the closure is pressed into the closed position. It can be seen that, similarly to the portion 9, the gripping region has a concave curve shape conforming to the cylindrical shape of the smoking article tube.

**[0028]** The insertion end 13 of the casing includes a holder 19, as shown in Figure 3, arranged for a smoking article tube to be positioned thereon in use. A user places a cigarette tube onto the holder, before moving the closure into the closed position so as to both press the smokable material into the cavity and secure the cigarette tube onto the holder. The tube remains clamped onto the holder by the gripping region of the closure, by way of the top part of an end of the tube being gripped between the holder and the curved gripping region, while the tube is filled with smokable material.

**[0029]** The closure is connected by a pivot to the portion of the device containing the cavity, however it may alternatively be attached to any other part of the device. It may also be connected to the device by alternative means, for example, a mechanism allowing the closure to slide vertically with respect to the casing so as to press tobacco into the opening 6 in the top of the casing. The closure or pressing portion may alternatively be detached or detachable from the device.

**[0030]** In use, the assembly comprising the closure and the cavity are slid backwards with respect to the device, along the direction of insertion, with the effect of pushing smokable material into the tube.

**[0031]** When the assembly comprising the closure and the section of the device containing the cavity is slid back, the gripped tube is pulled into the casing so that the tube envelops the smokable material. The driving of smokable material into the tube is facilitated by the support tongue (not shown). The support tongue is positioned at the bottom of the cavity such that when smokable material is placed into the cavity, the smokable material sits upon the tongue. During the action of sliding the assembly back, the strand of material remains upon the tongue as the tongue enters the tube through the aperture. The tongue may be curved around the axis of insertion such that its shape conforms to the curvature of the tube or the cavity. Once the tube has been filled, the assembly

is slid forward with respect to the device, returning to its original configuration, and the support tongue is withdrawn while the smokable material is retained in the tube. Opening the closure then releases the tube from the tube holder and the complete smoking article is removed.

**[0032]** With reference to Figure 3, a device 1 for making a smoking article according to the present invention is shown alongside an expanded view of the cavity 5 therein. It can be seen that the cavity has a region 15 of increased cross-sectional area in a direction perpendicular to the direction of insertion. The cavity therefore has an elongate cuboid shape except for a flared region 15 wherein the width increases towards the distal end 14. The method of using the device is the same as that described above. As previously described, filling the cavity to a uniform level and density naturally results in a slightly increased quantity at the end region 15. When the material is driven into a tube of substantially uniform diameter at 113, this slight excess of material from region 15 is compressed to a greater degree than the remainder of the material, resulting in a denser end than obtained with a state of the art MYO machine.

**[0033]** Hence, it is possible to compensate for the reduced density at the open end that is obtained with state of the art machines. By appropriate dimensioning of the end region, it is possible to either obtain a uniform density along the axis of the cigarette or obtain a higher density at the open end of the cigarette to avoid tobacco dropping off from the open end.

**[0034]** It can be seen that the pressing portion 9 of the closure is formed such that the face of the portion that confronts the smokable material has a shape which is complementary to the shape of the opening 6. The portion therefore has the shape of a bar featuring a widening region 16 that fits into the flared region 15 of the cavity.

**[0035]** Referring to Figure 4, a device 1 according to the invention is shown together with cross-sectional views of a cavity 4 having uniform width and a cavity 5 having a region 15 of increased width, and a smoking article 2.

**[0036]** The width and length of original cavity 4 are represented by  $D_0$  and  $L_0$  respectively. The modified cavity 5 has decreased uniform width  $D_1$  over the majority  $L_1$  of the cavity's length and a width, hence the cross section that increases linearly from  $D_1$  to  $D_2$  over the length  $L_2$  of end portion 15. It can be seen that the relationship between these width is  $D_1 < D_0 < D_2$ . The cross section could increase non-linearly from  $D_1$  to  $D_2$ , for example by defining a parabolic shape.

**[0037]** If the alternative cavities 4 and 5 are equal in length ( $L_0 = L_1 + L_2$ ) and volume, so as to accommodate an unchanged quantity of tobacco, the ratio of the density of tobacco in end portion 17 of the produced cigarette 2 to the density in the middle of the tube is  $x$ . The widths  $D_1$  and  $D_2$  can be determined by the formula:

$$D_1 = \frac{L_0}{(L_1 + xL_2)} D_0$$

$$D_2 = \frac{L_0}{(L_1 + xL_2)} (2x - 1) D_0$$

**[0038]** Referring to Figure 5, a cross-sectional view of two cavities 5 according to the invention are shown, wherein 5a represents a cavity as described previously, and the cavity at 5b contains multiple additional regions 18 of increased cross-sectional area in a direction perpendicular to the direction of insertion. In use, each of these regions has the same effect of containing an excess of material and consequently yielding a section of greater density compared to a standard cavity in the produced cigarette.

### Claims

1. A device for making a smoking article (2), the device comprising:

a casing (3) having an elongate structure and defining a cavity (4) for receiving smokable material (7) in use, the casing having an aperture (10) for receiving a smoking article tube (11) at an insertion end (13) thereof, the aperture being connected to the cavity, such that, in use smokable material within the cavity is driven into the tube so that a smoking article is created, **characterised in that** the cavity is arranged such that it has a region (15) of increased cross-sectional area in a direction perpendicular to the direction of tube insertion at an end opposite to the insertion aperture.

2. A device according to claim 1, wherein the smokable material (7) within the cavity (4) is driven into the tube (11) by the smoking article tube being slid into the casing (3).
3. A device according to claim 1 or claim 2, wherein the cavity (4) is arranged such that a cross section of the cavity increases linearly or non-linearly toward the end opposite to the insertion aperture (10).
4. A device according to any of claims 1 to 3, wherein the elongate direction of the casing (3) is aligned with the direction of tube insertion.
5. A device according to any of preceding claims, wherein the insertion aperture (10) is arranged to allow the insertion of the tube (11) into the cavity (4).
6. A device according to any of the preceding claims,

wherein the casing (3) further comprises an opening for receiving smokable material (7) therethrough in use, the opening being connected to the cavity (4).

7. A device according to claim 6, wherein in use, smokable material (7) is placed in the cavity (4) via the opening.
8. A device according to claim 6 or claim 7, wherein the device further comprises a closure (8) having a portion (9) arranged to cover the opening and press smokable material (7) into the cavity (4) in use.
9. A device according to claim 8, wherein in use, the smokable material (7) is pressed into the cavity (4) using the closure.
10. A device according to claim 8 or claim 9, wherein the closure is arranged to fasten the tube (11) within the insertion aperture (10) in use.
11. A device according to any of claims 8 to 10, wherein the said portion of the closure has a shape corresponding to the shape of the opening.
12. A device according to any of claims 8 to 11, wherein the closure is connected to the casing (3) by a pivot such that, in use, the closure may be moved with respect to the casing so as to open and close the opening.
13. A device according to any of the preceding claims, wherein the device further comprises a tongue for assisting the driving of smokable material (7) within the cavity (4) into the tube (11), the tongue being arranged so as to enter the tube along with the smokable material (7).
14. A device according to any of the preceding claims, wherein the cavity (4) is arranged such that it has more than one region (15) of increased cross-sectional area in a direction perpendicular to the direction of tube insertion.

### Patentansprüche

1. Vorrichtung zur Herstellung eines Rauchartikels (2), wobei die Vorrichtung umfasst:

Ein Gehäuse (3), das eine längliche Struktur aufweist und einen Hohlraum (4) zur Aufnahme von rauchbarem Material (7) im Gebrauch definiert, wobei das Gehäuse eine Öffnung (10) zur Aufnahme einer Rauchartikelhülse (11) an einem Einschubende (13) davon aufweist, wobei die Öffnung mit dem Hohlraum derartig verbunden ist, dass im Gebrauch rauchbares Material in-

- nerhalb des Hohlraums in die Hülse getrieben wird, sodass ein Rauchartikel geschaffen wird, **dadurch gekennzeichnet, dass** der Hohlraum derartig angeordnet ist, dass er einen Bereich (15) vergrößerter Querschnittsfläche in einer Richtung senkrecht zur Richtung der Hülseinschiebung an einem zur Einschuböffnung entgegengesetzten Ende aufweist.
2. Vorrichtung nach Anspruch 1, wobei das rauchbare Material (7) innerhalb des Hohlraums (4) von der Rauchartikelhülse, die in das Gehäuse (3) geschoben wird, in die Hülse (11) getrieben wird.
  3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei der Hohlraum (4) derartig angeordnet ist, dass ein Querschnitt des Hohlraums linear oder nicht linear in Richtung des Endes entgegengesetzt zur Einschuböffnung (10) zunimmt.
  4. Vorrichtung nach einem der Ansprüche 1 bis 3, wobei die längliche Richtung des Gehäuses (3) mit der Richtung der Hülseinschiebung fluchtet.
  5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Einschuböffnung (10) angeordnet ist, den Einschub der Hülse (11) in den Hohlraum (4) zu gestatten.
  6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das Gehäuse (3) ferner eine Öffnung zur Aufnahme rauchbaren Materials (7) dort hindurch in Gebrauch umfasst, wobei die Öffnung mit dem Hohlraum (4) verbunden ist.
  7. Vorrichtung nach Anspruch 6, wobei, im Gebrauch, rauchbares Material (7) über die Öffnung in den Hohlraum (4) platziert wird.
  8. Vorrichtung nach Anspruch 6 oder Anspruch 7, wobei die Vorrichtung ferner einen Verschluss (8) umfasst, der einen Abschnitt (9) aufweist, der eingerichtet ist, die Öffnung zu bedecken und das rauchbare Material (7) im Gebrauch in den Hohlraum (4) zu pressen.
  9. Vorrichtung nach Anspruch 8, wobei, im Gebrauch, das rauchbare Material (7) unter Verwendung des Verschlusses in den Hohlraum (4) gepresst wird.
  10. Vorrichtung nach Anspruch 8 oder Anspruch 9, wobei der Verschluss eingerichtet ist, die Hülse (11) im Gebrauch innerhalb der Einschuböffnung (10) zu befestigen.
  11. Vorrichtung nach einem der Ansprüche 8 bis 10, wobei der besagte Abschnitt des Verschlusses eine Form aufweist, die der Form der Öffnung entspricht.
  12. Vorrichtung nach einem der Abschnitte 8 bis 11, wobei der Verschluss mit dem Gehäuse (3) durch einen Drehzapfen im Gebrauch derartig verbunden ist, dass der Verschluss in Bezug auf das Gehäuse bewegt werden kann, um die Öffnung zu öffnen und zu schließen.
  13. Vorrichtung nach einem der vorhandenen Ansprüche, wobei die Vorrichtung ferner eine Zunge umfasst, um dabei behilflich zu sein, rauchbares Material (7) innerhalb des Hohlraums (4) in die Hülse (11) zu treiben, wobei die Zunge eingerichtet ist, zusammen mit dem rauchbaren Material (7) in die Hülse zu gelangen.
  14. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Hohlraum (4) derartig eingerichtet ist, dass er mehr als einen Bereich (15) vergrößerter Querschnittsfläche in einer Richtung senkrecht zur Richtung der Hülseinschiebung aufweist.

#### Revendications

1. Un dispositif de fabrication d'un article à fumer (2) qui se compose :  
d'un caisson (3) qui a une structure allongée et qui forme une cavité (4) de réception du produit à fumer (7) utilisé et ce caisson a une ouverture (10) d'admission d'un tube d'article à fumer (11) à une extrémité d'insertion (13) de cet élément et cette ouverture est raccordé à la cavité, de telle sorte que le produit à fumer utilisé présent dans cette cavité est introduit dans ce tube, ce qui entraîne la création d'un article à fumer, avec les caractéristiques suivantes : cette cavité a un agencement comporte une zone (15) dont la coupe est plus importante dans le sens perpendiculaire au sens d'insertion du tube à une extrémité opposée à l'ouverture d'insertion.
2. Un dispositif identique à celui qui est décrit dans la revendication 1, si ce n'est que le produit à fumer (7) qui se trouve dans la cavité (4) est introduit dans le tube (11) par le coulissage du tube d'article à fumer dans le caisson (3).
3. Un dispositif identique à celui qui est décrit dans la revendication 1 ou 2, si ce n'est que la cavité (4) est disposée de telle sorte qu'une coupe de cette cavité augmente de manière linéaire ou non linéaire en direction de l'extrémité opposée à l'ouverture d'insertion (10).
4. Un dispositif identique à celui qui est décrit dans l'une des revendications 1 à 3, si ce n'est que la direction allongée du caisson (3) vient s'aligner sur le sens d'insertion du tube.

5. Un dispositif identique à celui qui est décrit dans l'une des revendications précédentes, si ce n'est que l'ouverture d'insertion (10) est disposée de façon à permettre l'insertion du tube (11) dans la cavité (4). 5
6. Un dispositif identique à celui qui est décrit dans l'une des revendications précédentes, si ce n'est que le caisson (3) comporte, en outre, une ouverture permettant la réception de produit à fumer (7), pendant l'utilisation, et si ce n'est que cette ouverture est raccordée à la cavité (4). 10
7. Un dispositif identique à celui qui est décrit dans la revendication 6, si ce n'est que, pendant l'utilisation, le produit à fumer (7) est placé dans la cavité (4) par l'entremise de l'ouverture. 15
8. Un dispositif identique à celui qui est décrit dans la revendication 6 ou 7, si ce n'est que le dispositif comporte, en outre, une fermeture (8) dont une partie (9) est disposée de façon à recouvrir l'ouverture et à enfoncer le produit à fumer (7) dans la cavité (4) pendant l'utilisation. 20
9. Un dispositif identique à celui qui est décrit dans la revendication 8, si ce n'est que, pendant l'utilisation, le produit à fumer (7) est enfoncé dans la cavité (4) en faisant appel à la fermeture. 25
10. Un dispositif identique à celui qui est décrit dans la revendication 8 ou 9, si ce n'est que la fermeture est disposée de façon à rattacher le tube (11) dans l'ouverture d'insertion (10), pendant l'utilisation. 30
11. Un dispositif identique à celui qui est décrit dans l'une des revendications 8 à 10, si ce n'est que ladite partie de la fermeture a un profil qui correspond à celui de l'ouverture. 35
12. Un procédé identique à celui qui est décrit dans l'une des revendications 8 à 11, si ce n'est que la fermeture est rattachée au caisson (3) par un pivot de façon à ce que, pendant l'utilisation, la fermeture puisse se déplacer par rapport au caisson, de manière à ouvrir et fermer cette ouverture. 40 45
13. Un procédé identique à celui qui est décrit dans l'une des revendications précédentes, si ce n'est que ce dispositif comporte, en outre, une languette qui facilite l'insertion du produit à fumer (7) à l'intérieur de la cavité (4) dans le tube (11) et cette languette est disposée de manière à pénétrer dans le tube en même temps que le produit à fumer (7). 50
14. Un procédé identique à celui qui est décrit dans l'une des revendications précédentes, si ce n'est que la cavité (4) est disposée de telle sorte qu'elle comporte plus d'une zone (15) dont la coupe est plus importante, dans un sens perpendiculaire à la direction d'insertion du tube. 55

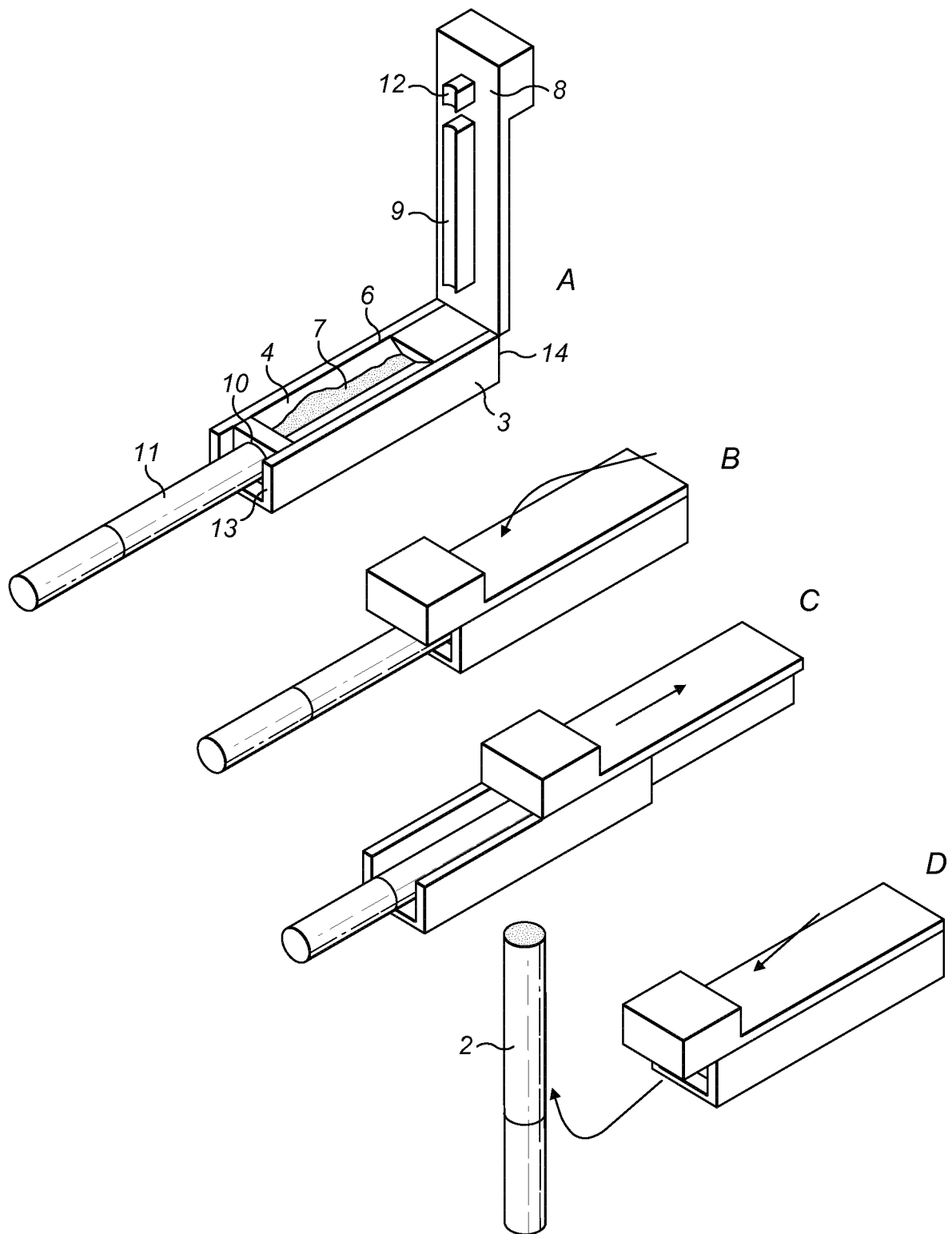
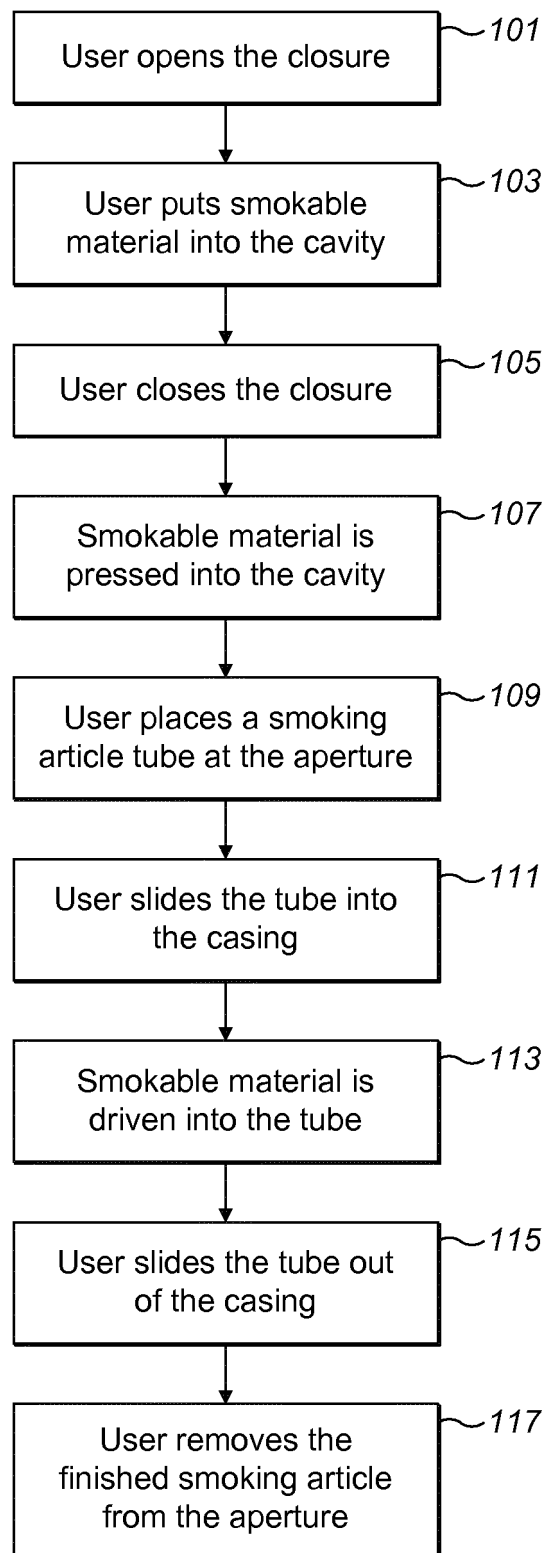


FIG. 1





**FIG. 2**

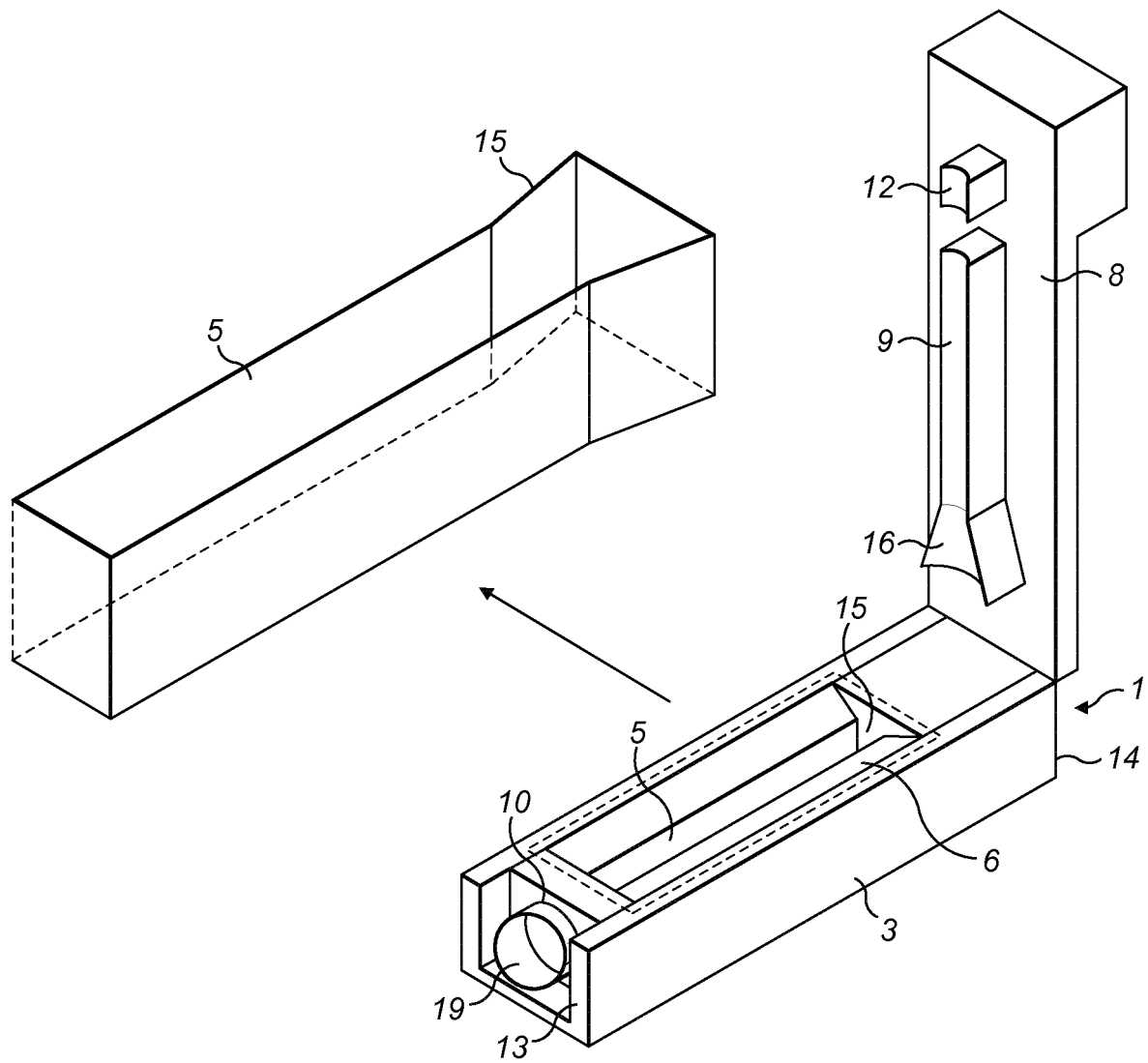


FIG. 3

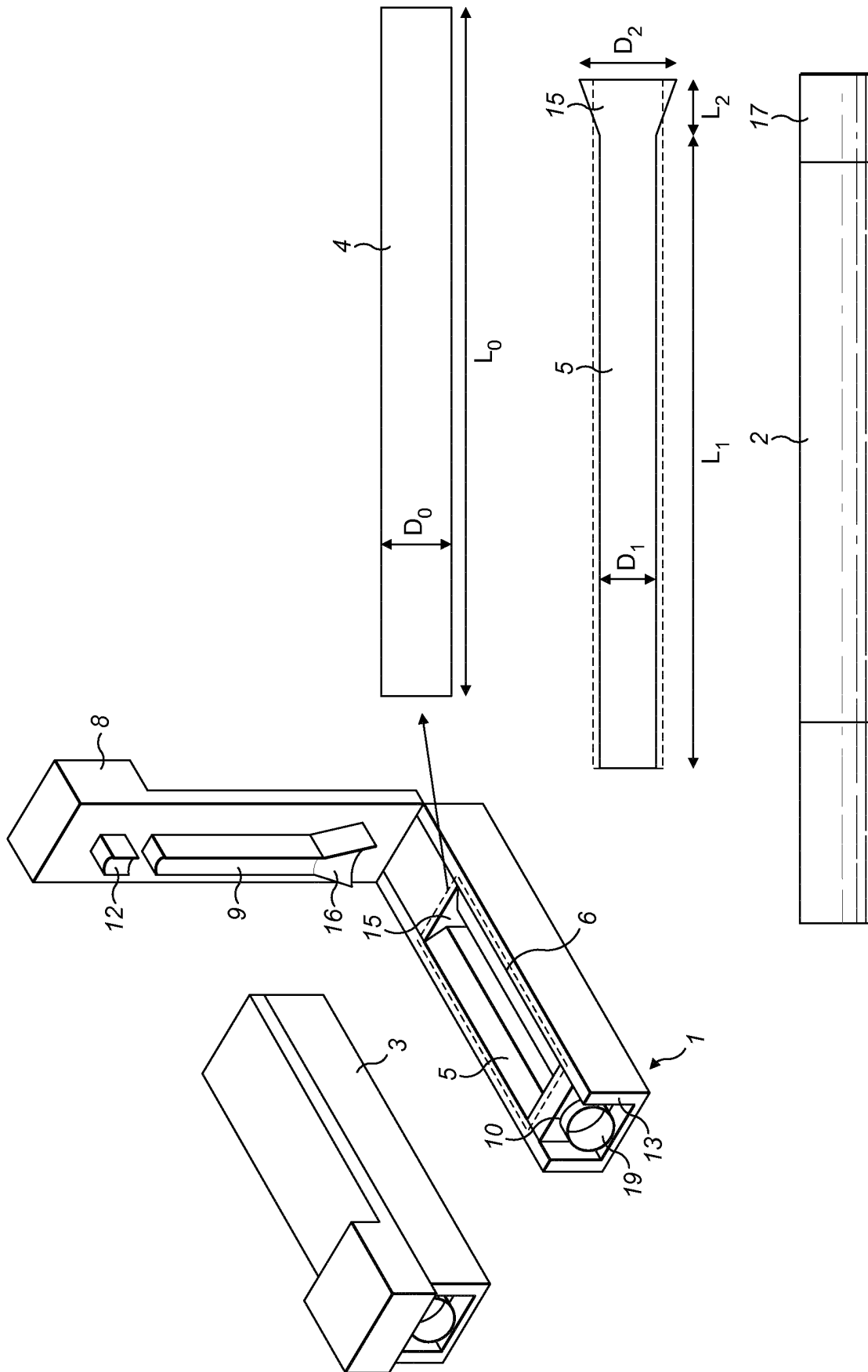


FIG. 4

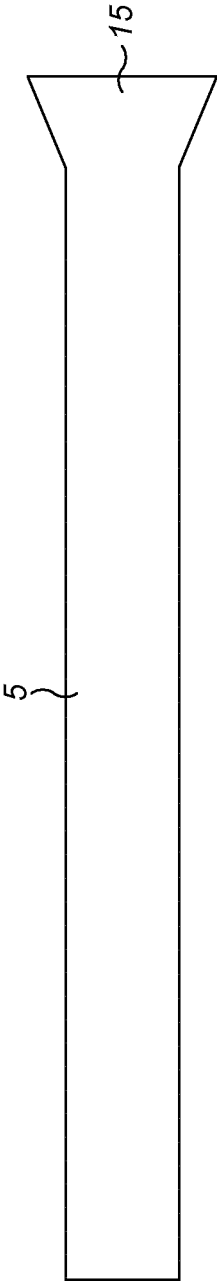


FIG. 5a

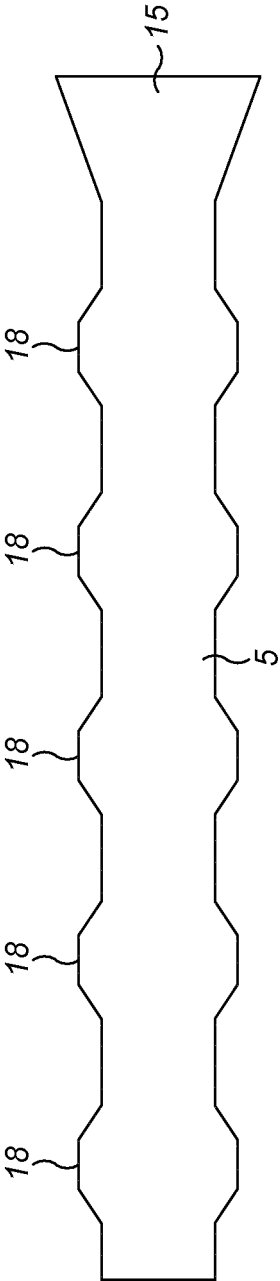


FIG. 5b

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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