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(54) FILTER FOR A SMOKING ARTICLE

(57) The invention relates to a filter (1) for a smoking article, a method of production thereof, a smoking article and a device for inserting a first fibrous filter material (3) into a second fibrous filter material (4) to form a filter for a smoking article. Particularly but not exclusively the invention relates to a smoking article filter segment including a region of first fibrous filter material disposed within a region of second fibrous filter material and a method of production thereof. The first fibrous filter material in some embodiments comprises greater than 10% by volume of the total filter segment volume and in some embodiments the first fibrous material comprises PLA fibres and the second fibrous filter material comprises CA fibres.

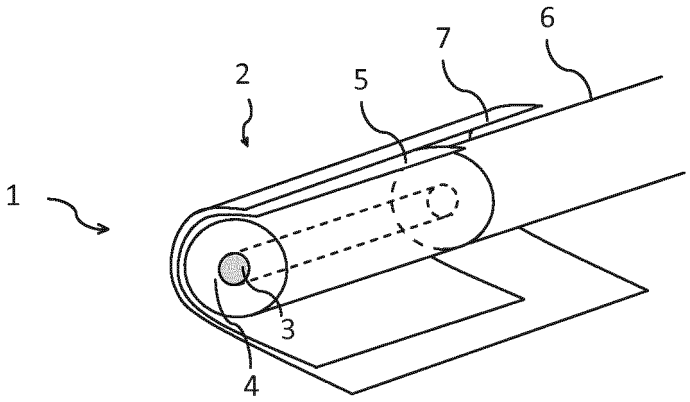

Fig. 1a

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Description

Technical Field

[0001] The invention relates to a filter for a smoking article, a method of production thereof, a smoking article and a device for inserting a first fibrous filter material into a second fibrous filter material to form a filter for a smoking article. Particularly but not exclusively the invention relates to a filter for a smoking article including a region of first fibrous filter material disposed at least substantially within a region of second fibrous filter material, a smoking article including such a filter and a method and device for the production thereof.

Background

[0002] It is known to use cellulose acetate fibres, plasticised with an additive such as triacetin, in cigarette filters. It is also known to use certain other fibrous materials, for instance cotton or paper based materials, as an alternative to cellulose acetate in cigarette filters.

Summary

[0003] In accordance with embodiments of the invention, there is provided a filter segment for a smoking article, the filter segment comprising a region of first fibrous filter material disposed at least substantially within a region of second fibrous filter material, wherein the first fibrous filter material comprises greater than 5% by volume of the total filter segment volume.

[0004] The first fibrous filter material can be disposed in a plurality of regions of the filter segment. The plurality of regions can each comprise greater than 3% of the total filter segment volume.

[0005] The second fibrous filter material can be a plasticised filter material and the first fibrous filter material can be a non-plasticised filter material.

[0006] The first and second fibrous filter materials can comprise crimped fibres.

[0007] The first fibrous filter material can comprise polylactide (PLA) fibres and/or the second fibrous filter material can comprise cellulose acetate fibres.

[0008] The first fibrous filter material can comprise from 5 to 60% by volume of the total filter segment volume.

[0009] The first fibrous filter material can comprise from 10 to 20% by volume of the total filter segment volume.

[0010] The first fibrous filter material can comprise from 200 to 10,000 fibres having a denier from 2 to 10 denier per filament.

[0011] The region of first fibrous filter material can comprise a region extending longitudinally through the region of second fibrous filter material.

[0012] There is also provided a filter segment for a smoking article, the filter segment comprising a region of first fibrous material disposed at least substantially within a region of second fibrous material, wherein the first fibrous material comprises polylactide (PLA) fibres.

[0013] The second fibrous material can comprise cellulose acetate (CA) fibres.

[0014] There is also provided a smoking article comprising a filter segment as set out above.

[0015] There is further provided a method of producing a filter segment for a smoking article, the method comprising feeding a supply of a first fibrous filter material into a second fibrous filter material to form a filter segment as set out above.

[0016] The method can further comprise applying a plasticiser to said second fibrous filter material prior to feeding the supply of the first fibrous material into the second fibrous filter material.

[0017] The method can further comprise crimping said first and second fibrous filter materials prior to feeding the supply of the first fibrous material into the second fibrous filter material.

[0018] The method can further comprise compressing said second fibrous filter material to form a filter rod and feeding the supply of the first fibrous filter material into the second fibrous filter material while compressing the second fibrous filter material to form the filter rod.

[0019] The first fibrous filter material can be fed into the second fibrous filter material in a tongue section of a filter making apparatus. The first fibrous filter material can comprise a thread of first fibrous filter material.

[0020] There is further provided a method of producing a filter for a smoking article, the method comprising generating a fluid stream and transferring a first fibrous material along a transfer path into a flow of a second fibrous filter material using the fluid stream.

[0021] The fluid stream can be generated using air pressure.

[0022] The first fibrous filter material can be transferred into the flow of the second fibrous filter material in a tongue or stuffer jet section of a filter making apparatus.

[0023] There is further provided a device for inserting a first fibrous filter material into a second fibrous filter material to form a filter for a smoking article, the device comprising a pressure generator to generate a fluid stream for carrying said first fibrous material along a transfer path into a flow of said second fibrous filter material.

[0024] There is further provided a filter for a smoking article, as herein described with reference to the accompanying drawings.

[0025] There is further provided a smoking article as herein described with reference to the accompanying drawings.

[0026] There is further provided a fibrous material insertion device as herein described with reference to the accompanying drawings.

Brief Description of the Drawings

[0027] Embodiments of the invention will now be described, by way of example only, with reference to the

accompanying drawings, in which:

Figures 1(a) to 1(e) are schematic illustrations of smoking articles including filter segments according to embodiments of the invention;

Figure 2 is a schematic illustration of a first device for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those of the smoking articles illustrated in Figures 1(a) to i(d);

Figure 3 is a schematic side view of a section of the device of Figure 2;

Figure 4 is a schematic rear view of a section of the device of Figure 2;

Figure 5 is a schematic illustration of a second device for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those of the smoking articles illustrated in Figures 1(a) to i(d);

Figure 6 is a schematic side view of a section of the device of Figure 5;

Figure 7 is a schematic rear view of a section of the device of Figure 5;

Figure 8 is a schematic illustration of a third device according to an embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that of the smoking article illustrated in Figure 1(a);

Figure 9 is a cross sectional schematic view of the device of Figure 8;

Figure 10 is a cross sectional view of the venture device shown in Figures 8 and 9;

Figure 11 is a schematic illustration showing the operation of the venturi device of Figures 8, 9 and 10;

Figure 12 is a cross sectional schematic view of a fourth device according to a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that of the smoking article illustrated in Figure 1(a);

Figure 13 is a schematic illustration of a fifth device according to a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those of the smoking articles illustrated in Figures 1(a) to i(d); and

Figure 14 is a schematic illustration of a sixth device according to a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that illustrated in Figure 1(e).

Detailed Description

[0028] Figures 1(a) to 1(e) are schematic illustrations of smoking articles including filter segments according to embodiments of the invention.

[0029] As used herein, the term "smoking article" includes smokeable products such as cigarettes, cigars and cigarillos whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco or tobacco substitutes and also heat-not-burn products.

[0030] Referring to Figure 1(a), a first smoking article 1 includes a filter segment 2 having a region of first fibrous filter material 3 disposed substantially within a region of second fibrous filter material 4. In the first smoking article 1, the filter segment 2 forms a mono filter having an overall cylindrical shape, with the first fibrous filter material 3 disposed within a substantially cylindrically shaped core region of the second fibrous filter material 4, which forms an outer, hollow cylindrically shaped region of the filter segment 2. The first fibrous filter material 3 accordingly extends axially through the length second fibrous filter material 4, being in the present example exposed only at each end of the mono filter.

[0031] The filter segment 2 of the first smoking article 1 is wrapped in a plug wrap material 5 and connected to a tobacco rod 6 using a tipping material 7 to form the first smoking article 1, in the present example a cigarette.

[0032] Referring to Figure 1(b), a second smoking article 11 includes a filter segment 12 having first and second regions of a first fibrous filter material 13a, 13b disposed substantially within a region of second fibrous filter material 14. In the second smoking article 11, the filter segment 12 forms a mono filter having an overall cylindrical shape, with the first fibrous filter material 13a, 13b disposed within first and second regions of the second fibrous filter material 14. The first and second regions extend longitudinally through the length of the second fibrous filter material 14, being in the present example exposed from the second fibrous filter material 14 only at each end of the mono filter. The first and second regions of first fibrous filter material 13a, 13b are substantially cylindrical in shape. In the present example, the first and second regions of first fibrous filter material 13a, 13b are diametrically spaced apart from each other and from the outer longitudinal periphery of the second fibrous filter material 14.

[0033] The filter segment 12 of the second smoking article 11 is wrapped in a plug wrap material 15 and connected to a tobacco rod 16 using a tipping material 17 to form the second smoking article 11, in the present example a cigarette.

[0034] Referring to Figure 1(c), a third smoking article 21 includes a filter segment 22 having a plurality of regions of first fibrous filter material 23a - 23d disposed substantially within a second fibrous filter material 24. In the third smoking article 21, the filter segment 22 forms a mono filter having an overall cylindrical shape, with the first fibrous filter material 23a - 23d disposed within first to fourth regions. Each of the four regions of first fibrous filter material 23a - 23d extends longitudinally through the length second fibrous filter material 24, being in the present example exposed from the second fibrous filter material 24 only at each end of the mono filter. The regions of first fibrous filter material 23a - 23d are substan-

tially cylindrical in shape. In the present example, the regions of first fibrous filter material 23a - 23d are annularly disposed within the second filter material 24 and spaced at 90° from each other and from the outer longitudinal periphery of the second fibrous filter material 24.

[0035] The filter segment 22 of the third smoking article 21 is wrapped in a plug wrap material 25 and connected to a tobacco rod 26 using a tipping material 27 to form the third smoking article 21, in the present case a cigarette.

[0036] Referring to Figure 1(d), a fourth smoking article 31 includes a filter segment 32 having a plurality of regions of first fibrous filter material 33a - 33e disposed substantially within a region of second fibrous filter material 34. In the example of Figure 1(d), the filter segment 32 forms a mono filter having an overall cylindrical shape, with the first fibrous filter material 33a - 23e disposed within first to fifth regions. Each of the five regions of first fibrous filter material 33a - 33e extends longitudinally through the length of the second fibrous filter material 34, being in the present example exposed from the second fibrous filter material 34 only at each end of the mono filter. The regions of first fibrous filter material 33a - 33e are substantially cylindrical in shape. In the present example, the first to fourth regions of first fibrous filter material 33a-33d are annularly disposed within the second filter material 34 and spaced at 90° from each other and from the outer longitudinal periphery of the second fibrous filter material 34. The fifth region of first fibrous filter material 33e is disposed within a substantially cylindrically shaped core of the second fibrous filter material 34.

[0037] The filter segment 32 is wrapped in a plug wrap material 35 and connected to a tobacco rod 36 using a tipping material 37 to form the third smoking article 31, in the present case a cigarette.

[0038] Referring to Figure 1(e), a fifth smoking article 161 includes a filter segment 162 having a plurality of regions of first fibrous filter material 16a - 163b disposed substantially within a region of second fibrous filter material 164. In the example of Figure 1(e), the filter segment 162 forms a mono filter having an overall cylindrical shape, with the first fibrous filter material 163a - 163b disposed within first and second regions. Each of the first and second regions of first fibrous filter material 163a - 163b forms an elongate sector of the cylindrical filter, and extends longitudinally through the length of the second fibrous filter material 164, being in the present example exposed from the second fibrous filter material 164 at each end of the mono filter and along the length of first and second outer portions 165a, 165b of the longitudinal surface of the cylindrical filter segment 162.

[0039] The regions of first fibrous filter material 163a - 163b have the substantial shape of elongate sectors in the present example. Also, the first and second regions of first fibrous filter material 163a - 163b are disposed within the second filter material 164 spaced at 180° from each other. However, alternatively only one region of first fibrous filter material 163 can be used, or three or more regions of first fibrous filter material 163 can be used, spaced evenly or unevenly around the filter segment 162. Also, the shape of the regions of first fibrous filter material, whether one, two, three or more regions, is not limited to an elongate sector, and could be shaped substantially to have the form of an elongate quadrilateral, such as a rectangle and/or oblong.

[0040] The filter segment 162 is wrapped in a plug wrap material 166 and connected to a tobacco rod 167 using a tipping material 168 to form the fifth smoking article 161, in the present case a cigarette.

[0041] In the first to fifth smoking articles 1, 11, 21, 31, 161, the first fibrous filter material 3, 13, 23, 33, 163 comprises a non-plasticised filter material, in the present case polylactide (also referred to as poly(lactic acid) or PLA) fibres. Such fibres are commercially available, for instance from companies such as Natureworks LLC in the US or Mitsui Chemical in Japan. Suitable fibres can be formed in processes such as electrospinning, as would be known to those skilled in the art. The second fibrous filter material 4, 14, 24, 34, 164 comprises a plasticised filter material, in the present case cellulose acetate (hereinafter 'CA') fibres plasticised using triacetin (also referred to as glycerin triacetate).

[0042] Use of both the first and the second fibrous filter materials in a single filter segment can enable the smoking article filter to benefit from properties of both materials. For instance, the first and second filter materials may each have greater selectivity in the filtration of certain smoke constituents than the other material. One or other of the first and second filter materials may be cheaper to produce or comprise a more sustainable base material than the other filter material. For example, PLA is generally considered to be a more sustainable filter material than CA, although plasticised CA can have a greater filtration selectivity to certain smoke constituents than PLA, for instance phenols.

[0043] A limitation of PLA fibres and other non-cellulose acetate based fibre materials can be that the fibres are relatively soft and that certain CA filter plasticisers such as triacetin, polyethylene glycol (PEG) and triethyl citrate (TEC), usually used to increase the firmness of CA filters, are not sufficiently effective at increasing the firmness of the non-cellulose acetate material or mixtures of the non-cellulose acetate material with CA. Accordingly, such filters may not be provided with an appropriate rigidity and/or hardness for use in/as smoking article filters. The filter segment structures provided in the first to fourth smoking articles 1, 11, 21, 31, 161 of Figures 1(a) to 1(e) and other embodiments of the invention can overcome such limitations by enabling a first filter material such as PLA fibres to be held substantially within the structure of a second filter material such as CA fibres. The second filter material such as CA fibres can, for instance, be plasticised to provide an appropriate rigidity and/or hardness to the overall filter segment 2, 12, 22, 32, 162.

[0044] Other suitable materials for the first fibrous filter material include paper or paper-based materials, polyvinyl alcohol (PVOH) or PVOH based materials, starch-based materials, reconstituted tobacco materials, extruded materials or other fibrous filter materials, for instance those which cannot be readily plasticised by a cellulose acetate plasticiser (although the invention is not limited to the use of such materials).

[0045] Other suitable materials for the second fibrous filter material include paper or paper-based materials, polyvinyl alcohol (PVOH) or PVOH based materials, starch-based materials, reconstituted tobacco materials, extruded materials or other fibrous filter materials.

[0046] The first and/or second fibrous filter material can be coloured and/or include an additive such as a flavourant, for instance menthol or coffee (where local regulations permit the use of such flavourants) or an adsorbent such as activated carbon granules or an ion exchange resin, giving the filter segment unique flavouring or filtration properties, and/or a unique end appearance.

[0047] Including the first fibrous filter material in one or more regions substantially within the second fibrous filter material can enable the second fibrous filter material to be plasticised, or cured, with the first fibrous filter material inserted into the one or more regions during the manufacturing process, for instance after a plasticiser has been applied to the second filter material. This can help to locate the first filter material into a desired position within the second filter material, which can have the associated advantage of improving the end appearance of the filter.

[0048] In each of the first to fifth smoking articles 1, 11, 21, 31, 161 illustrated in Figures 1(a) to 1(e), the first fibrous filter material 3, 13, 23, 33, 163 can, for instance, comprise from 5% to 70% of the total filter segment volume. The fibres of the first filter material, in the present examples PLA fibres, can, for instance, have a filament denier of from 2 to 10, more particularly from 2 to 7, and can be formed using, for instance, between 200 and 10,000 fibres per region in which they are located. The fibres of the second filter segment, in the present examples CA fibres, can have a filament denier of from 2 to 10, more particularly from 2 to 7, and between 5,000 and 20,000 fibres can, for instance, be used to form the filter. Appropriate fibre deniers and numbers of filaments for each of the first and second filter materials can be selected according to various factors, such as the crimp applied to either or each of these materials, the desired ratio of the volumes of these materials, the desired total denier for the filter, the desired pressure drop and or hardness for the filter, apparatus capabilities and desired apparatus operating speeds. The second fibrous filter material can be plasticised with triacetin, or another plasticiser, used in an amount from, for instance, 5% to 12% by weight of the plasticised fibres.

[0049] The filter segment 2 of Figure 1(a) includes 10% by volume of the first fibrous filter material 3, in that example PLA, and 90% by volume of plasticised CA, in which triacetin accounts for 8% by weight of the CA.

[0050] The filter segment 12 of the second smoking article 11 illustrated in Figure 1(b) includes 12% by volume of the first fibrous filter material 13, in that example PLA, and 88% by volume of the second fibrous filter material 14, in that case plasticised CA, in which triacetin accounts for 8% by weight of the CA. Each region of the first fibrous filter material 13 comprises 6% of the total filter segment volume.

[0051] The filter segment 22 of the third smoking article 21 illustrated in Figure 1(c) includes 16% by volume of the first fibrous filter material 23, in that example PLA, and 84% by volume of the second fibrous filter material 24, in that case plasticised CA, in which triacetin accounts for 8% by weight of the CA. Each of the four regions of the first fibrous filter material comprises 4% of the total filter segment volume.

[0052] The filter segment 32 of the fourth smoking article 31 illustrated in Figure 1(d) includes 20% by volume of the first fibrous filter material 33, in that example PLA, and 80% by volume of the second fibrous filter material 34, in that case plasticised CA, in which triacetin accounts for 8% by weight of the CA. Each of the five regions of the first fibrous filter material 33 comprises 4% of the total filter segment volume.

[0053] The filter segment 162 of the fifth smoking article 161 illustrated in Figure 1(e) includes 40% by volume of the first fibrous filter material 163, in that example PLA, and 60% by volume of the second fibrous filter material 164, in that case plasticised CA, in which triacetin accounts for 8% by weight of the CA. Each of the first and second regions 163a, 163b of the first fibrous filter material 163 comprises 20% of the total filter segment volume.

[0054] Alternative relative volumes of the first and second fibrous filter materials can be used, and these will depend on the chosen materials, the fibre denier of the materials, the number of filaments used, and the level of crimp which is applied to each material. The volume of the first fibrous material can, for instance, comprise up to 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 or 70% of the total filter segment volume. The first fibrous material can also be used in lower volumes, for instance down to 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4.5, 4, 3.5, 3, 2.5, 2, 1.5 or 1% of the total filter segment volume. The volume of the first fibrous material can, accordingly, fall within a range comprising from one of 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4.5, 4, 3.5, 3, 2.5, 2, 1.5 or 1% of the total filter segment volume up to one of 20, 25, 30, 35, 40, 45, 50, 55, 60, 65 or 70% of the total filter segment volume, in particular from 10% to 70% of the total filter segment volume.

[0055] Each of the regions of first fibrous filter material can comprise greater than 2%, greater than 2.5%, greater than 3%, greater than 3.5%, greater than 4% or greater than 5% of the total filter segment volume, for instance from 2%, 3%, 4% or 5% to 20%, 25% or 30% of the total filter segment volume.

[0056] The first fibrous filter material 3, 13, 23, 33 in the first to fourth smoking articles is disposed in one or more regions spaced from the outer longitudinal periphery of the second fibrous filter material 4, 14, 24, 34, such that the first fibrous filter material 3, 13, 23, 33 is present at the outer surface of the cylinder (or other shape) formed by the first and second filter materials only at each end of the filter segment. However, alternatively, the first fibrous filter material 3, 13, 23, 33 in the first to fourth smoking articles can be disposed in a region part of the boundary of which is coexistent with the outer periphery of the filter segment formed by the first and second filter materials such that the first fibrous filter material is present at the outer surface of the filter segment at each end of the filter segment and/or at one or more parts of the outer longitudinal periphery of the filter segment (such latter surfaces being in contact with a plug wrap in the present examples).

[0057] The first fibrous filter material 3, 13, 23, 33, 163 in the first to fifth smoking articles is disposed such that it is at the outer boundary of the respective filter segments 2, 12, 22, 32, 162 at each end of the filter segments. However, alternatively, the first fibrous filter material 3, 13, 23, 33, 163 can be disposed in at least one region which is not at the outer boundary of the second fibrous filter material 4, 14, 24, 34, 164 at either end of the respective filter segment or which is at the outer boundary of the filter segment at one but not both ends of the filter segment.

[0058] The first fibrous filter material 3, 13, 23, 33, 163 in the first to fifth smoking articles is disposed in up to five separate regions. However, the first fibrous filter material 3, 13, 23, 33, 163 can be disposed in greater than five regions, such as 6, 7, 8, 9, 10, 11 or 12 regions, so as to provide a desired volume or weight of the first fibrous filter material 3, 13, 23, 33, 163 within the filter segment 2, 12, 22, 32, 162.

[0059] As used herein, the term filter segment refers to a single discrete filter component which can be individually attached to a smoking article. The filter segments 2, 12, 22, 32, 162 used in the first to fifth smoking articles 1, 11, 21, 31, 161 are mono filter segments, comprising the entire filter for such smoking articles 1, 11, 21, 31, 161. However, the filter segments 2, 12, 22, 32, 162 can alternatively be used in other filter configurations, such as the mouth end, tobacco end or both segments of a dual, dual dalmatian or cavity filters, or one or more of the mouth end, intermediate and tobacco end segments of a triple or quad filter. One or more of the segments of the filter may comprise non-wrapped acetate (NWA) segments.

[0060] The first and/or second fibrous filter materials 3, 4, 13, 14, 23, 24, 33, 34, 163, 164 can comprise mixtures of different materials, for instance mixtures of fibres of a plurality of materials or the fibres themselves being formed from blends or composites of a plurality of materials.

[0061] Figures 2 to 4 are schematic illustrations of a first device 40 for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those of the smoking articles illustrated in Figures 1(a) to 1(d). Such a device is described in more detail in International patent publication WO2010/108739, the contents of which are expressly incorporated herein by reference, and can be adapted for use in producing filter segments according to the present invention in the manner set out below.

[0062] The first device 40, in use, is connected to a filter making apparatus such as the KDF 2 apparatus produced by Hauni Maschinenbau AG in Germany and is capable of producing a filter rod with up to five separate regions of a first fibrous filter material extending through the cross-section of the filter formed from a second fibrous filter material. The first device 40 comprises a tongue 41 having a wide entrance opening 41b and a narrow exit opening 41a, a funnel 42 and a stuffer jet 43. The filter making apparatus includes a garniture, filter wrapping paper and wrapping paper-spool as well as other sections, not illustrated here. The first device 40 also includes a multi-region material positioning unit, generally indicated as 44. The multi-region material positioning unit 44 comprises a support block 45 which is attached to a support fin 41c which extends vertically upwards from the tongue 41. The support block 45 is fixedly secured in place on the fin 41c of the tongue 41 by known connectors such as bolts, welds, etc.

[0063] The support block 45 includes five apertures 46a - 46e extending therethough. A first aperture 46a extends from the centre of the top of the support block 45 downwards to the tongue 41, and second and third apertures 46b, 46c extend from either side of the first aperture 46a on the top of the support block 45 downwards to the tongue 41. Furthermore, fourth and fifth apertures 46d, 46e extend from the left and right sides of the support block 45 respectively, laterally through the support block 45 to the tongue 41. Each aperture 46a-e is inclined at an angle so as not to be perpendicular to the central axis of the tongue 41 and to point slightly in the direction of the exit opening 41a, as shown in Figures 2 and 3. The tongue 41 includes a plurality of apertures 47a-47e in its side wall extending through to the bore of the tongue 41, wherein each of the apertures 47a-e is aligned with one of the apertures 46a-e in the support block 45, so as to provide a plurality of continuous passages though the support block 45 and through the lateral wall of the tongue 41 to the central bore of the tongue 41.

[0064] Five needles 48a-e are provided, one disposed in each of the apertures 46a-e in the support block 45 which extend through the respective aperture 47a-e in the tongue 41. Therefore, each needle 48a-e extends from outside the support block 45, though the support block 45 and through the wall of the tongue 41 and terminates within the bore of the tongue 41. The needles have internal passage diameters appropriate for carrying fibres used to form the regions of the first filter material used in the filter segments of the present invention.

[0065] An outer portion of each of the apertures 46a-e in the support block 45 is of a larger diameter than the inner portion proximate the tongue 41, and is threaded to receive a correspondingly threaded locking shaft 49a-e. The locking shafts 49a-e each include a hollow bore (not shown) through which, in use, a respective needle 48a-e extends, and the locking shaft 49a-e comprises a first continuous section at its lower end, and a second, fingered section (not shown) at its upper end. The fingered section is formed by a plurality of radial slots cut from the top end of the locking shaft 49a-e downwards and extending all the way through from the inner bore through to the outside of the locking shaft 49a-e. The remaining threaded sections of the 'fingers' are thereby defined between the slots and are deflectable in a radial direction of the locking shaft 49a-e.

[0066] Also shown in Figures 2 to 4 are locking nuts 50a-e which include an internal thread corresponding to the external thread of the locking shafts 49a-e, and which are shaped to taper inwardly slightly so that as each locking nut 50a-e is threaded onto the fingered section of each locking shaft 49a-e, the fingers are caused to be deflected inwards into the inner bore of the locking shafts 49a-e. The inner bore of the locking shaft is of the same diameter as that of the inner portion of the apertures 46a-e which extend through the support block 45 and of the apertures 47a-e which are formed in the lateral wall of the tongue 41, so that needles 48a-e fit snugly in the respective bores of the locking shafts 49a-e. It will therefore be appreciated that as the locking nuts 50a-e are threaded and tightened onto the respective locking shafts 49a-e, they cause the fingers to be deflected inwards, and so when a needle 48a-e is disposed in the inner bore of the locking shaft 49a-e, tightening the locking nuts 50a-e causes the fingers to be biased against the needle 48a-e, thereby fixing the needle 48a-e in the chosen position.

[0067] It will be appreciated that the same effect may be achieved with a non-tapering locking nut having a constant thread diameter if the upper part of the locking shaft comprising the fingers slightly tapers outwards in a direction towards the tongue 41. Thereby, as the locking nut is threaded further onto the locking shaft, the fingers would be caused to deform inwards, thereby binding against the needle 48a-e to fix it in place relative to the locking shaft and thereby the tongue 41.

[0068] In use, a second fibrous filter material, for instance continuous fibres of crimped CA filter tow material, is conveyed through the bore of the tongue 41, and up to five individual supplies of the first fibrous filter material, for instance continuous crimped fibrous PLA or other material in thread or strand form, are fed through the needles 48a-e and entrained in the flow of the second fibrous filter material, being pulled through the needles 48a-e as the second material passes through the tongue 41. The supply of the first fibrous filter material to the needles 48a-e can be achieved using a mechanical or electromechanical delivery device such as feed rollers, a feed conveyor, fluted feed drum or screw feeder (not shown) configured to feed the first fibrous material from a continuous supply thereof. Such a mechanical or electromechanical delivery device can have its speed adjusted so as to meter the first fibrous material into the second fibrous filter material at an appropriate rate, for instance according to the speed of the second fibrous filter material passing through the tongue 41. The emerging compressed filter rod which exits from the narrow exit opening 41a in the tongue 41 accordingly has up to five separate continuous regions of the first material therein extending in an axial direction thereof.

[0069] The exact position of the regions of first fibrous filter material within the cross-section of the resulting filter rod can be accurately determined and adjusted since the position of the first fibre regions in the cross-section of the filter rod is dictated by the point within the tongue 41 at which the ends of the needles 48a-e terminate. This can be altered as described above, with each needle 48a-e being independently adjustable to create a wide variety of patterns within the resulting filter rod. The device 40 can accordingly be used to produce filter rods containing up to five regions of a first fibrous material along the length of a second fibrous material. Filter rods having fewer than five regions of the first fibrous material therethrough can be produced by not feeding supplies of the first fibrous material through one or more of the needles 48a-e.

[0070] Figures 5 to 7 are schematic illustrations of a second device 60 for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those illustrated in Figures 1(a) to i(d).

[0071] The second device 60 of Figures 5 to 7 is similar to the first device 40 of Figures 2 to 4. The second device 60 in use, is connected to a filter making apparatus such as the KDF 2 apparatus produced by Hauni Maschinenbau AG in Germany and is capable of producing a filter rod with up to five separate regions of a first fibrous filter material extending through the cross-section of the filter formed from a second fibrous filter material. The second device 60 comprises a tongue 61 having a wide entrance opening 61b and a narrow exit opening 61a, a funnel 62 and a stuffer jet 63. The filter making apparatus in which the second device 60 is used includes a garniture, filter wrapping paper and wrapping paper-spool as well as other sections, not illustrated here. The second device 60 also includes a multi-region material positioning unit, generally indicated as 64. The multi-region material positioning unit 64 comprises a support block 65 which is attached to a support fin 61c which extends vertically upwards from the tongue 61. The support block 65 is fixedly secured in place on the fin 61c of the tongue 61 by known connectors such as bolts, welds, etc.

[0072] The support block 65 includes five apertures 66a - 66e extending therethough, similar to the apertures 46a-e of the support block 45 of the first device. The tongue 61 also includes a plurality of apertures 67a - 67e in its side wall extending through to the bore of the tongue 61, wherein each of the apertures 67a-e is aligned with

one of the apertures 66a-e in the support block 65, so as to provide a plurality of continuous passages though the support block 65 and through the lateral wall of the tongue 61 to the central bore of the tongue 61.

[0073] Five needles 68a-e are provided, one disposed in each of the apertures 66a-e in the support block 65 which extend through the respective aperture 67a-e in the tongue 61. Therefore, each needle 68a-e extends from outside the support block 65, though the support block 65 and through the wall of the tongue 61 and terminates within the bore of the tongue 61. Similarly to the first device 40, the needles 68a-e have internal passage diameters appropriate for carrying fibres used to form the regions of the first filter material used in the filter segments of the present invention.

[0074] An outer portion of each of the apertures 66a-e in the support block 65 is of a larger diameter than the inner portion proximate the tongue 61, and is threaded to receive a correspondingly threaded locking shaft 69a-e. The locking shafts 69a-e each include a hollow bore (not shown) through which, in use, a respective needle 68a-e extends. The locking shafts 69a-e are similar to those of the first device 40.

[0075] Also shown in Figures 5 to 7 are locking nuts 70a-e which are similar to and operate in the same way as the locking nuts 50a-e of the first device 40.

[0076] The second device 60 differs from the first device 40 by the orientation of the first, second and third apertures 66a-c formed in the support block 65, and thereby the orientation of the plurality of continuous passages though the support block 65 and through the lateral wall of the tongue 61 to the central bore of the tongue 61. Accordingly, the needles 68a-c respectively disposed in each of the first to third apertures 66a-c are correspondingly differently orientated.

[0077] It can be seen from Figure 7 that the first, second and third needles 68a-c are arranged radially with respect to the central axis of the tongue 61, as opposed to the first, second and third needles 48a-c of the first device 40, which are all arranged with their respective axes parallel to each other. This alternative orientation of the first, second and third needles 68a-c provides a different range of first fibrous material region positions to be achieved within the filter rod and, in particular, allows closer positioning of these three first fibrous material regions to each other and to the two other first fibrous material regions from the fourth and fifth needles 68d-e to be achieved. This is due to the fact that the radial orientation of the first to third needles 68a-c means that when they are adjusted inwards, the ends of the needles 68a-c converge towards the central axis of the bore of the tongue 68, rather than remaining the same spacing from each other with respect to a horizontal line across the cross-section of the tongue 61.

[0078] In use, the second device 60 is operated in the same way as the first device 40 described above. A second fibrous filter material, for instance continuous fibres of crimped CA filter tow material, is conveyed through the bore of the tongue 61, and up to five individual supplies of the first fibrous filter material, for instance continuous crimped fibrous PLA or other material in the form of a thread or strands and fed through the needles 68a-e and entrained in the flow of the second fibrous filter material, being pulled through the needles 68a-e as the second material passes through the tongue 61. The supply of the first fibrous filter material to the needles 68a-e can be achieved using a mechanical or electromechanical delivery device such as feed rollers, a feed conveyor, fluted feed drum or screw feeder (not shown) configured to feed the first fibrous material from a continuous supply thereof. Such a mechanical or electromechanical delivery device can have its speed adjusted so as to meter the first fibrous material into the second fibrous filter material at an appropriate rate, for instance according to the speed of the second fibrous filter material passing through the tongue 61. The emerging compressed filter rod which exits from the narrow exit opening 61a in the tongue 61 accordingly has up to five separate continuous regions of the first material therein extending in an axial direction thereof.

[0079] Figures 8 and 9 are schematic illustrations of a third device 80 according to an embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that illustrated in Figure 1(a).

[0080] Figure 8 shows part of the third device 80 comprising a fibre insert section 81. During operation of the third device 80, a second fibrous filter material 82, in the form of cellulose acetate tow in the present example, is drawn through a set of conveying rollers (not shown), and is compressed through a stuffer jet (not shown) and through the tongue 83 of a garniture 84, where it is paper wrapped with a plugwrap 85 and subsequently cut into segments by a cutter (not shown) to form filter rods.

[0081] Figure 9 shows a cross section of the third device 80. The fibre insert section 81 comprises a fibre feed tube 86, a venturi insert device 87 and an insert tube 88. The insert tube 88 forms a fibre transfer path, in the present example from the venture insert device 87 to the tongue 83, and may be bent so that it can be aligned longitudinally with the direction in which the filter rod material 82 is conveyed in the tongue 83. The position of the insert tube 88 may be adjusted using the insert tube adjustment wheel 88a shown in Figure 8. This allows the stream of fibres to be positioned along the longitudinal axis of the second filter material 84 or alternatively off-centre but parallel to the longitudinal axis. The fibre insert section 81 also comprises first, second and third air jet inlets 89a-c.

[0082] The feed tube 86 is configured to accept fibres of a first fibrous filter material for insertion into a second fibrous filter material, the first fibrous material being supplied, for instance, in the form of a thread or strands of the first fibrous material. The supply of the first fibrous filter material to the feed tube 86 can be achieved using a mechanical or electromechanical delivery device such

as feed rollers, a feed conveyor, fluted feed drum or screw feeder (not shown) configured to feed the first fibrous material from a continuous supply thereof. Such a mechanical or electromechanical delivery device can have its speed adjusted so as to meter the first fibrous material into the second fibrous filter material at an appropriate rate, for instance according to the speed of the second fibrous filter material passing through the tongue 83. The emerging compressed filter rod which exits from the tongue 83 accordingly has a continuous region of the first material therein extending in an axial direction thereof.

[0083] Figure 10 is an enlarged cross sectional view of the venturi device 87 shown in Figure 8. The venturi device 87 comprises a generally conical block 90 with an axial bore 91 having an inlet 92 that receives a supply of fibres 93 from the feed tube 86 and an outlet 94 that supplies the fibres 93 into the insert tube 88.

[0084] The conical block 90 is received within a generally cylindrical housing 95 with a conical end spaced from the block 90 to define a converging air passageway 96 which opens into the insert tube 88 in the region of the outlet 94 of the bore 91.

[0085] The air supply passageway 96 is fed with compressed air from the three air jet inlets 89a-c, the first of which 89a is shown in Figure 10. The air jet inlets 89a-c are coupled to a compressed air or other gas source (not shown) and feed into respective longitudinal bores 97a,b that connect into the converging air supply passageway 96. Although the first, second and third jet inlets 89a-c are fed with air, other fluids could be employed, for example helium or nitrogen.

[0086] Fibres 93 are received from the feed tube 86 and are directed into the axial bore 91. Compressed air from the first inlet 89a is directed along the longitudinal bore 97 towards the region 94 where the axial bore 91 and the longitudinal bore 97 converge. Compressed air from the second and third inlets 89b, 89c is also directed along corresponding respective longitudinal bores (not shown) for these inlets towards the region 94 where the axial bore 91 and those longitudinal bores converge.

[0087] During operation of the venturi device 87 the Venturi effect is exploited to propel the fibres 93 towards the filter rod material 92 as it is formed into filter rods.

[0088] Figure 11 schematically illustrates the air flow in the venturi device 87 during operation of the fibre insert section 81. As air is propelled from the first and second jet sources 89a, 89b through the longitudinal bores 97a, 97b and into the insert tube 88, an area of low pressure is created in the region 94 and insert tube 88. The fibres 93 initially occupy an area of high pressure relative to this low pressure region 94. A pressure gradient force is created that acts on the fibres 93 and propels them into the insert tube 88 with a velocity greater than if they were to be acted upon by the force due to gravity alone. This allows a high density of fibres 93 to be inserted into the second fibrous filter rod material. The insert tube 88 feeds into the tongue 83 of the third device 80 to insert fibres directly into the second fibrous filter material.

[0089] The position of the insert tube 88 may be adjusted relative to the longitudinal axis of the filter rod under manufacture. In Figure 9 the insert tube 88 is bent however in other embodiments the insert tube 88 may be straight. The fibres may be centred along the longitudinal axis of the filter rod or substantially parallel to but offset from the longitudinal axis using the insert tube adjustment wheel 88a shown in Figure 8.

[0090] Figure 12 is a cross sectional schematic view of a fourth device 100 in accordance with a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that illustrated in Figure 1(a). The fourth device 100 shown in Figure 12 is similar to the third device 80 shown in Figure 8. However, the fourth device 100 shown in Figure 12 comprises a high flow vacuum pump 101 instead of the venturi insert device 87 shown in Figure 8. The fourth device 100 also comprises a fibre feed tube 102 and an exit tube 103.

[0091] The high flow vacuum pump 101 may be of a type known in the art for material transfer such as KVPDF High Flow Vacuum Pumps, or vacuum pumps such as the DF Series pumps supplied by Vaccon Company, Inc in the US. Compressed air enters the vacuum pump 101 through an air inlet 104 and flows cyclonically through a central tube 105 of the pump 101. The cyclonic flow of compressed air produces a vacuum which can draw fibres from the feed tube 102, through the central tube 105 and into the exit tube 103 to converge with the tongue 106 of the garniture (as shown in Figure 8).

[0092] Compressed air can be supplied to the air inlet 104 at between 10 and 60 Psi, for instance from 10 to 40 Psi, or preferably at about 30 Psi.

[0093] The feed tube 102 is configured to accept fibres of a first fibrous filter material for insertion into a second fibrous filter material, the first fibrous material being supplied, for instance, in the form of a thread or strands of the first fibrous material. The supply of the first fibrous filter material to the feed tube 102 can be achieved using a mechanical or electromechanical delivery device such as feed rollers, a feed conveyor, fluted feed drum or screw feeder (not shown) configured to feed the first fibrous material from a continuous supply thereof. Such a mechanical or electromechanical delivery device can have its speed adjusted so as to meter the first fibrous material into the second fibrous filter material at an appropriate rate, for instance according to the speed of the second fibrous filter material passing through the tongue 106. The emerging compressed filter rod which exits from the tongue 106 accordingly has a continuous region of the first material therein extending in an axial direction thereof.

[0094] Figure 13 is a schematic illustration of a fifth device 110 according to a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as those of the smoking articles illustrated in Figures 1(a) to i(d).

[0095] The fifth device 110 of Figure 13 includes components similar to the second device 60 of Figures 5 to 7. The fifth device 110 in use, is connected to a filter making apparatus such as the KDF 2 apparatus produced by Hauni Maschinenbau AG in Germany and is capable of producing a filter rod with up to five separate regions of a first fibrous filter material extending through the cross-section of the filter formed from a second fibrous filter material.

[0096] The fifth device 110 comprises a tongue 111 having a wide entrance opening 111b and a narrow exit opening 111a, a funnel 112 and a stuffer jet 113. The filter making apparatus in which the fifth device 110 is used includes a garniture, filter wrapping paper and wrapping paper-spool as well as other sections, not illustrated here. The fifth device 110 also includes a multi-region material positioning unit, generally indicated as 114.

[0097] The multi-region material positioning unit 114 comprises a support block 115 which is attached to a support fin 111c which extends vertically upwards from the tongue 111. The support block 115 is fixedly secured in place on the fin 111c of the tongue 111 by known connectors such as bolts, welds, etc.

[0098] The support block 115 includes five apertures 116a - 116e extending therethough, similar to the apertures 66a-e of the support block 65 of the second device. The tongue 111 also includes a plurality of apertures (not shown) in its side wall extending through to the bore of the tongue 111, wherein each of the apertures is aligned with one of the apertures 116a-e in the support block 115, so as to provide a plurality of continuous passages though the support block 115 and through the lateral wall of the tongue 111 to the central bore of the tongue 111.

[0099] Five needles 118a-e are provided, one disposed in each of the apertures 116a-e in the support block 115 which extend through the respective apertures in the tongue 111. Therefore, each needle 118a-e extends from outside the support block 115, though the support block 115 and through the wall of the tongue 111 and terminates within the bore of the tongue 111. Similarly to the second device 60, the needles 118a-e have internal passage diameters appropriate for carrying fibres used to form the regions of the first filter material used in the filter segments of the present invention.

[0100] The fifth device also includes locking shafts 119a-e and locking nuts 120a-e which are similar to and operate in the same way as those of the first and second devices 40, 60.

[0101] The fifth device 110 differs from the second device 60 in that a fibre insert section is connected to each of the needles 118a-e (although only illustrated in respect of the fourth needle 118d in Figure 13). The fibre insert sections correspond to the fibre insert section 81 of Figures 8 and 9. The fibre insert section 130 connected to the fourth needle 118d comprises a fibre feed tube 131 and a venturi insert device 132. The venturi devices 132 each comprise a generally conical block with an axial bore having an inlet that receives a supply of fibres from the feed tube 131 and an outlet that supplies the fibres into the needles 118. Air supply passageways within the venture devices 132 are fed with compressed air from the three air jet inlets 133a-c. The venturi insert device 132 has its fibre stream outlet connected to the fourth needle 118d. The fourth needle 118d forms a fibre transfer path, in the present example from the venture insert device 132 to the tongue 111. The fibre insert sections (not shown) connected to the first, second, third and fifth needles 118a,b,c,e comprise corresponding features to those of the fibre insert section 130 connected to the fourth needle 118d.

[0102] In use, the fibre insert sections operate in a corresponding manner to the fibre insert section 81 of Figures 8 and 9, with the venturi device in each section operating in the same manner as the venturi device 87 described with reference to Figures 10 and 11. Accordingly, during operation of the fifth device 110, a second fibrous filter material, in the form of cellulose acetate tow in the present example, is drawn through a set of conveying rollers (not shown), and is compressed through the stuffer jet 113 and through the tongue 111 of a garniture, where it is paper wrapped with a plugwrap and subsequently cut into segments by a cutter (not shown) to form filter rods. At the same time, the venturi devices of each fibre insert section are operated by supplying compressed air to the air inlets 133a-c at between 10 and 60 Psi, for instance from 10 to 40 Psi, or preferably at about 30 Psi such that the Venturi effect is exploited to propel fibres of a first filter material into regions of the second filter material as it is formed into filter rods.

[0103] Figure 14 is a schematic illustration of a sixth device 140 according to a further embodiment of the invention for inserting a first fibrous filter material into a second fibrous filter material to produce a filter segment such as that illustrated in Figure 1(e).

[0104] The sixth device 140 of Figure 14 is, in use, is connected to a filter making apparatus such as the KDF 2 apparatus produced by Hauni Maschinenbau AG in Germany and is capable of producing a filter rod with a region of a first fibrous filter material extending through the cross-section of the filter formed from a second fibrous filter material.

[0105] The sixth device 140 comprises a tongue 141, a funnel 142 and a stuffer jet 143. The filter making apparatus in which the second device 140 is used includes a garniture, filter wrapping paper and wrapping paper-spool as well as other sections, not illustrated here.

[0106] The sixth device 140 also includes a fibre insert unit 144 used to supply a first fibrous filter material into the stuffer jet 143. Although only one fibre insert unit 144 is shown, two, three or more fibre insert units 144 can be used simultaneously. The fibre insert unit 144, in the present example, comprises a DF Series vacuum pump as supplied by Vaccon Company, Inc in the US. The fibre insert unit 144 includes a fibre insert tube 145 used to feed a first filter material into a second fibrous filter material flow 146 passing through the stuffer jet 143. The

fibre insert unit 144 is mounted on an adjustable support member (not shown), which enables the position of the outlet of the tube 145 in relation to the stuffer jet 143 to be accurately set. The fibre insert unit 144 further comprises a fibre inlet 147 for receiving a supply of first fibrous material and a compressed ait inlet 148 for receiving a supply of compressed air, for instance at between 10 and 60 Psi, for instance from 10 to 40 Psi, or about 30 Psi.

[0107] In use, the fibre insert unit 144 is supplied with compressed air and creates an internal vacuum forcing a supply of a first fibrous filter material as hereinbefore described into the stuffer jet 143. Accordingly, during operation of the sixth device 140, a second fibrous filter material, in the form of cellulose acetate tow in the present example, is drawn through a set of conveying rollers (not shown), and is compressed through the stuffer jet 143 and through the tongue 141 of a garniture, where it is paper wrapped with a plugwrap and subsequently cut into segments by a cutter (not shown) to form filter rods. At the same time, the fibre insert unit 144 is operated such that fibres of a first filter material are transported into a region of the second filter material as it is formed into filter rods.

[0108] The sixth device 140 has the advantage that the first filter material is inserted into the second filter material at a point upstream of the tongue 141 where the second filter material is relatively uncompressed. This can enable more diverse regions of first filter material to be inserted into a second fibrous filter material, forming shapes such as the elongate sections described with reference to Figure 1(e).

[0109] Although only one fibre insert unit 144 is used in the example illustrated in Figure 14, multiple fibre insert unit 144 can be inserted into the stuffer jet, for instance 2, 3, 4, 5 or 6 separate tubes, each having corresponding adjustable support members.

[0110] Although a venturi device 132 has been used in the fifth device 110, of Figure 13, alternatively a high flow vacuum pump such as that described with reference to Figures 12 and 14 can be used in place of one or more of the venturi devices 132 (i.e. each of the first to fifth devices of the fifth device 110 of Figure 13).

[0111] The embodiments of Figures 8 to 14, by using a fluid stream to insert a first fibrous filter material into a second fibrous filter material can insert the first fibrous filter material at a greater rate than the flow rate of the second fibrous filter material. Such feeding is referred to as over-feeding and can, for instance, be used to insert the first fibrous filter material such that the ratio of the second fibrous filter material rate : first fibrous filter material rate is in the range 1:1.1 to 1:2, more preferably in the range 1:1.1 to 1:1.5.

[0112] In order to address various issues and advance the art, the entirety of this disclosure shows by way of illustration various embodiments in which the claimed invention(s) may be practiced and provide for superior filters, filter production methods, smoking articles and filter production devices. The advantages and features of the disclosure are of a representative sample of embodiments only, and are not exhaustive and/or exclusive. They are presented only to assist in understanding and teach the claimed features. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects of the disclosure are not to be considered limitations on the disclosure as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope and/or spirit of the disclosure. Various embodiments may suitably comprise, consist of, or consist essentially of, various combinations of the disclosed elements, components, features, parts, steps, means, etc. In addition, the disclosure includes other inventions not presently claimed, but which may be claimed in future.

Claims

1. A filter segment for a smoking article, the filter segment comprising a region of first fibrous filter material disposed at least substantially within a region of second fibrous filter material, wherein the first fibrous filter material comprises greater than 5% by volume of the total filter segment volume.

2. A filter segment according to claim 1, wherein the first fibrous filter material is disposed in a plurality of regions of the filter segment.

3. A filter segment according to claim 2, wherein the plurality of regions can each comprise greater than 3% of the total filter segment volume.

4. A filter segment according to claim 1, 2 or 3, wherein the second fibrous filter material is a plasticised filter material and wherein the first fibrous filter material is a non-plasticised filter material, and/or wherein the first and second fibrous filter materials comprise crimped fibres.

5. A filter segment according to any preceding claim, wherein the first fibrous filter material comprises polylactide (PLA) fibres and/or the second fibrous filter material comprises cellulose acetate fibres.

6. A filter segment according to any preceding claim, wherein the first fibrous filter material comprises from 5 to 60% by volume of the total filter segment volume or from 10 to 60% by volume of the total filter segment volume.

7. A filter segment according to any preceding claim, wherein the first fibrous filter material comprises from 200 to 10,000 fibres having a denier from 2 to 10 denier per filament.

8. A filter segment according to any preceding claim, wherein the region of first fibrous filter material comprises a region extending longitudinally through the region of second fibrous filter material.

9. A smoking article comprising a filter segment according to any one of the preceding claims.

10. A method of producing a filter segment for a smoking article, the method comprising:

    feeding a supply of a first fibrous filter material into a second fibrous filter material to form a filter segment according to any one of claims 1 to 10.

11. A method according to claim 10, further comprising applying a plasticiser to said second fibrous filter material prior to feeding the supply of the first fibrous material into the second fibrous filter material.

12. A method according to claim 10 or 11, further comprising crimping said first and second fibrous filter materials prior to feeding the supply of the first fibrous material into the second fibrous filter material.

13. A method according to claim 10, 11 or 12, further comprising compressing said second fibrous filter material to form a filter rod and feeding the supply of the first fibrous filter material into the second fibrous filter material while compressing the second fibrous filter material to form the filter rod.

14. A method according to claim 13, wherein the first fibrous filter material is fed into the second fibrous filter material in a tongue section of a filter making apparatus.

15. A method according to any one of claims 10 to 14, wherein the first fibrous filter material comprises a thread of first fibrous filter material.

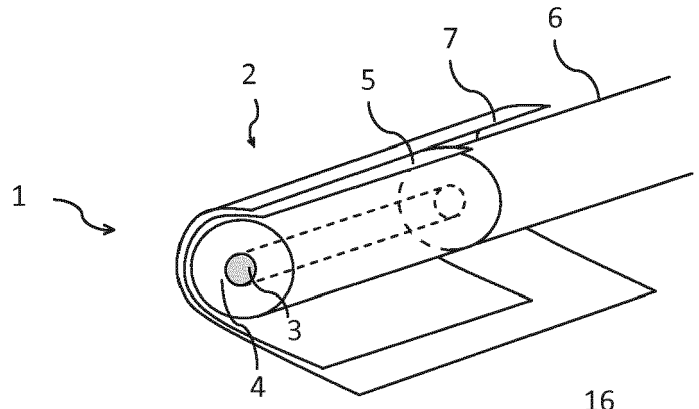


Fig. 1a

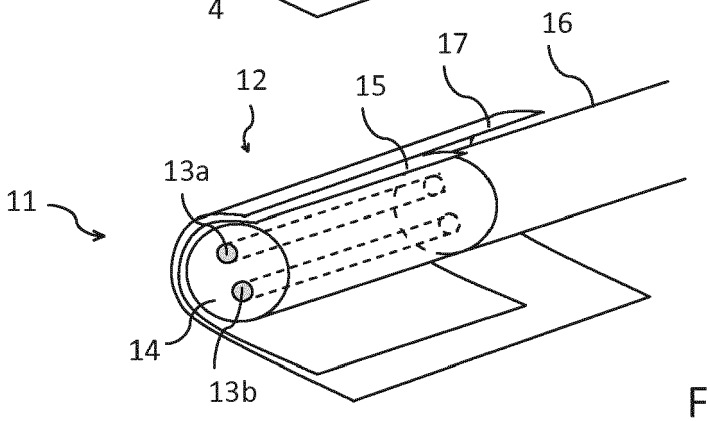


Fig. 1b

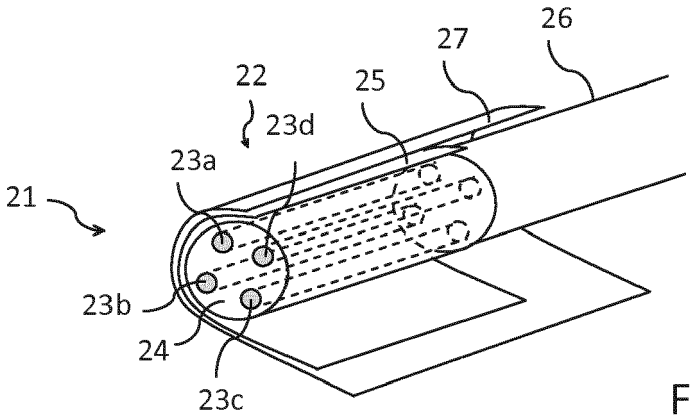


Fig. 1c

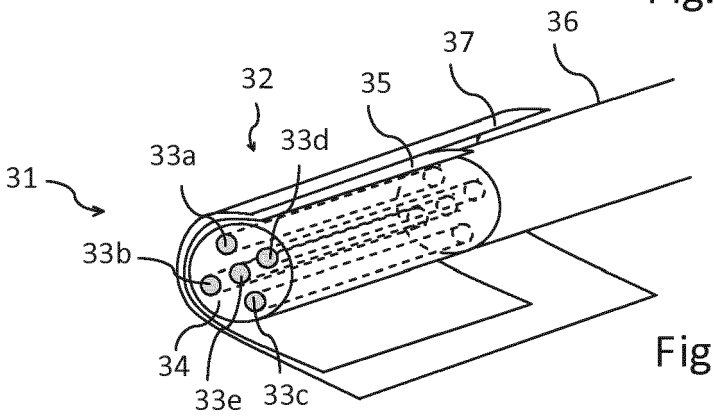


Fig. 1d

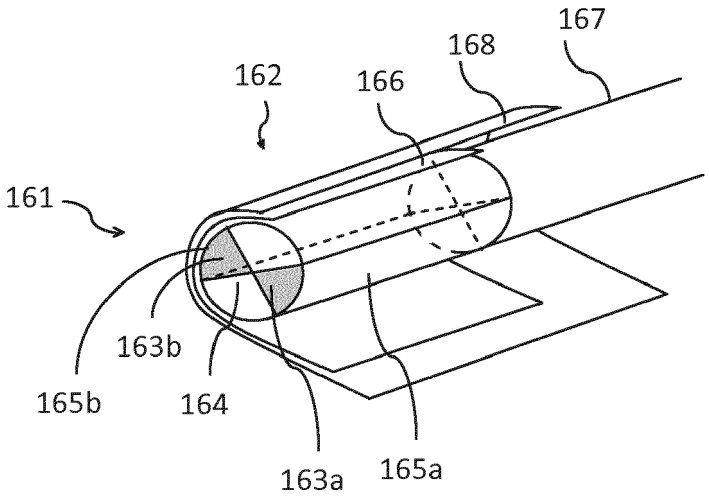
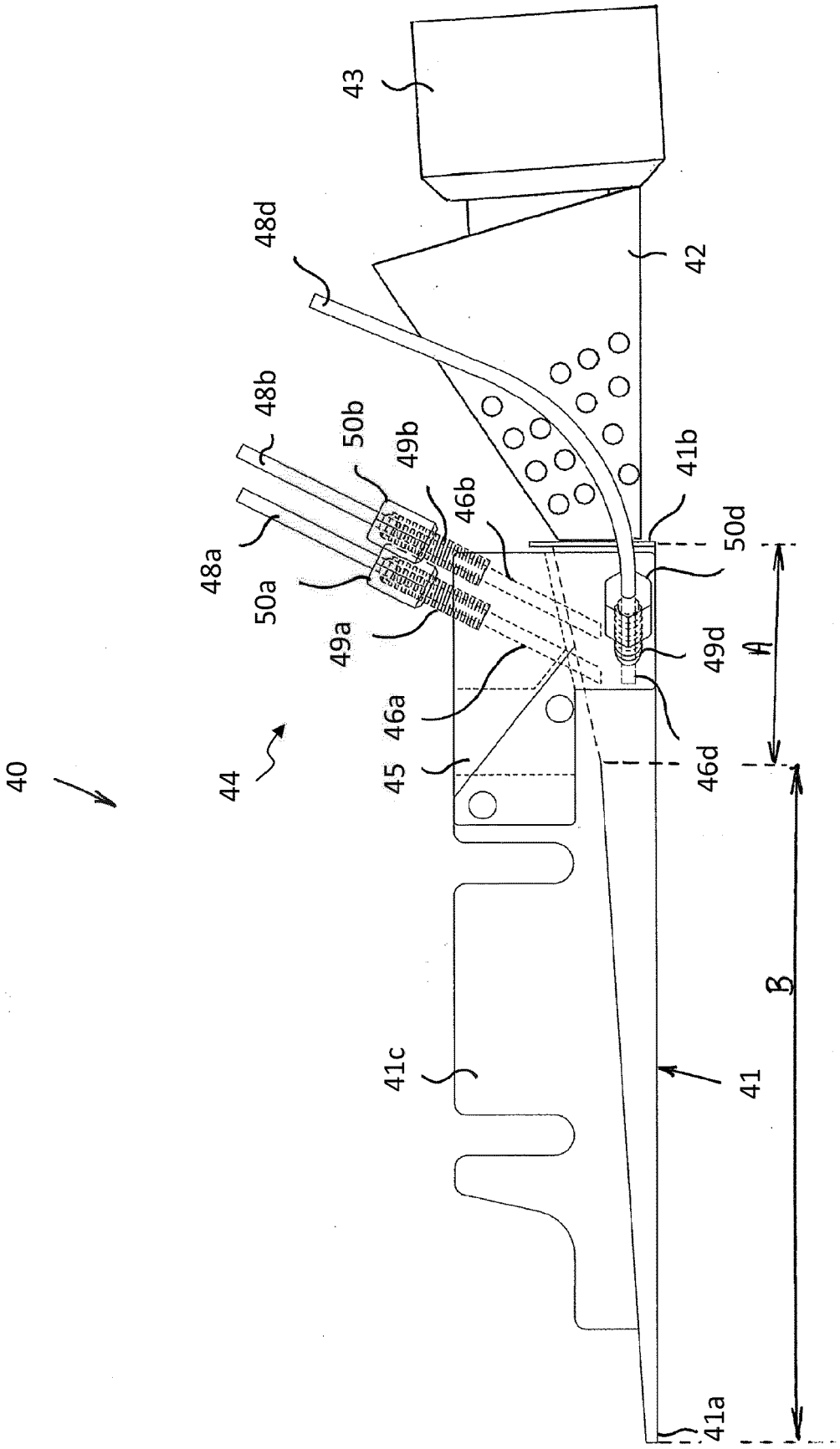


Fig. 1e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B

Fig. 2

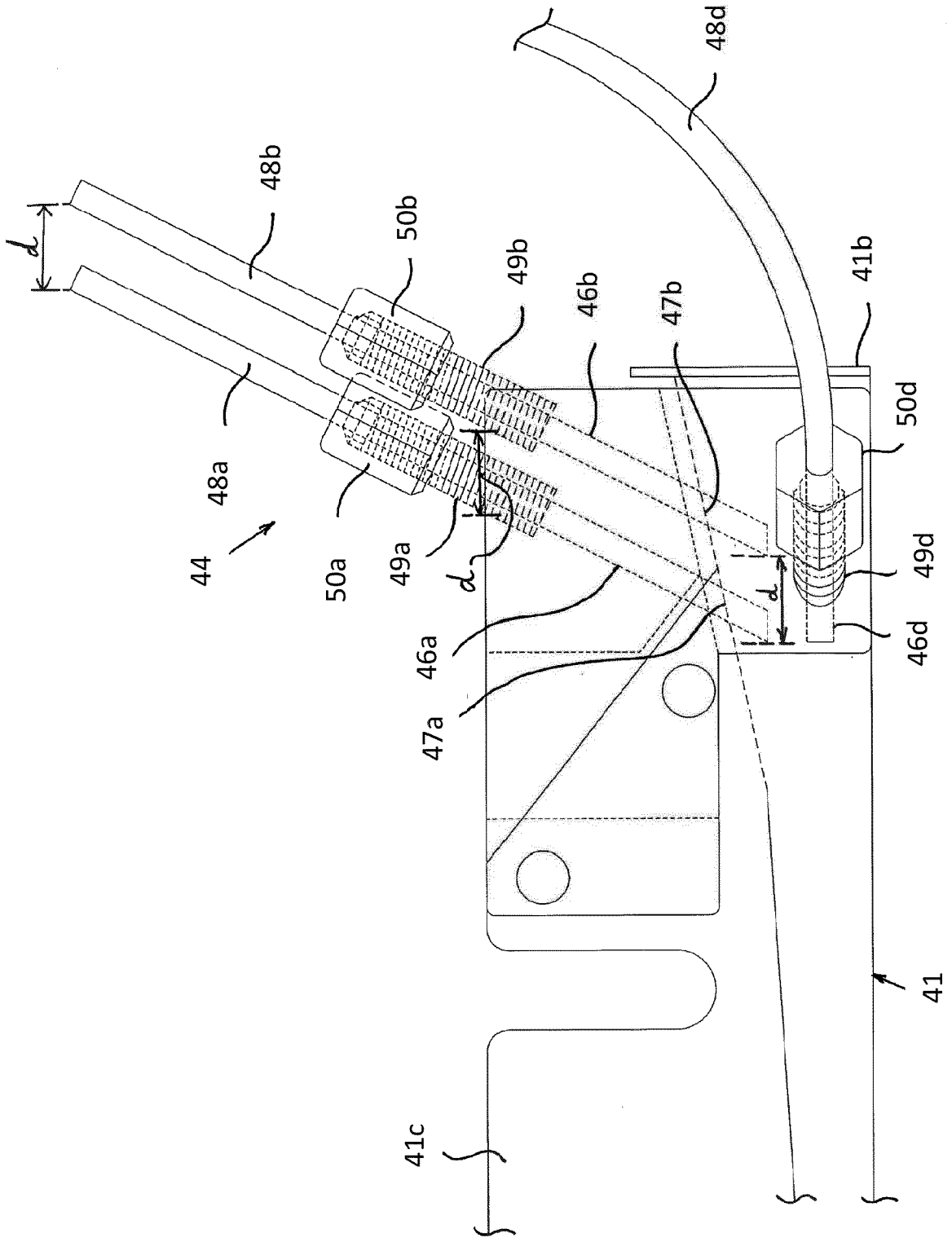
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Fig. 3

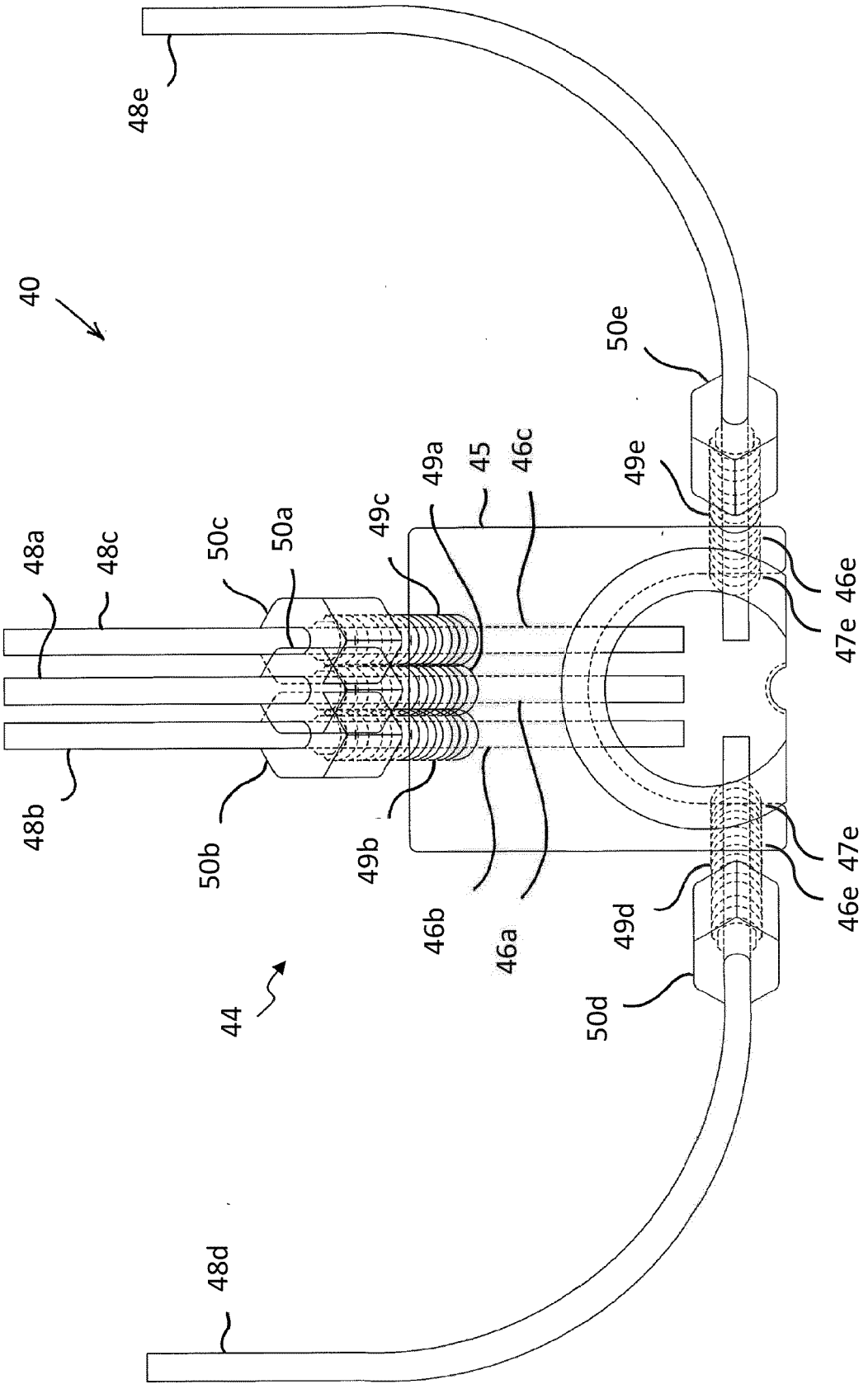
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Fig. 4

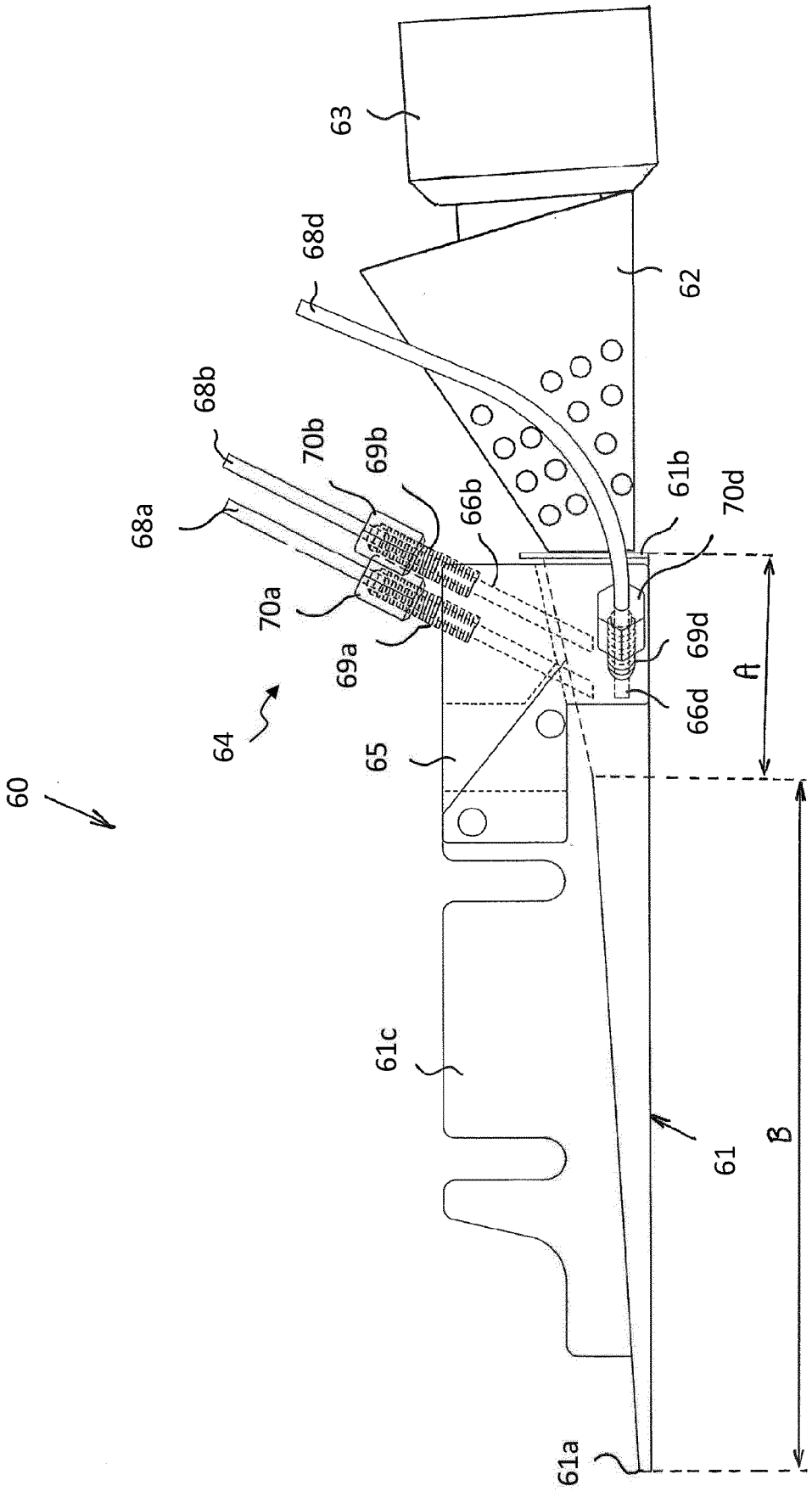
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Fig. 5

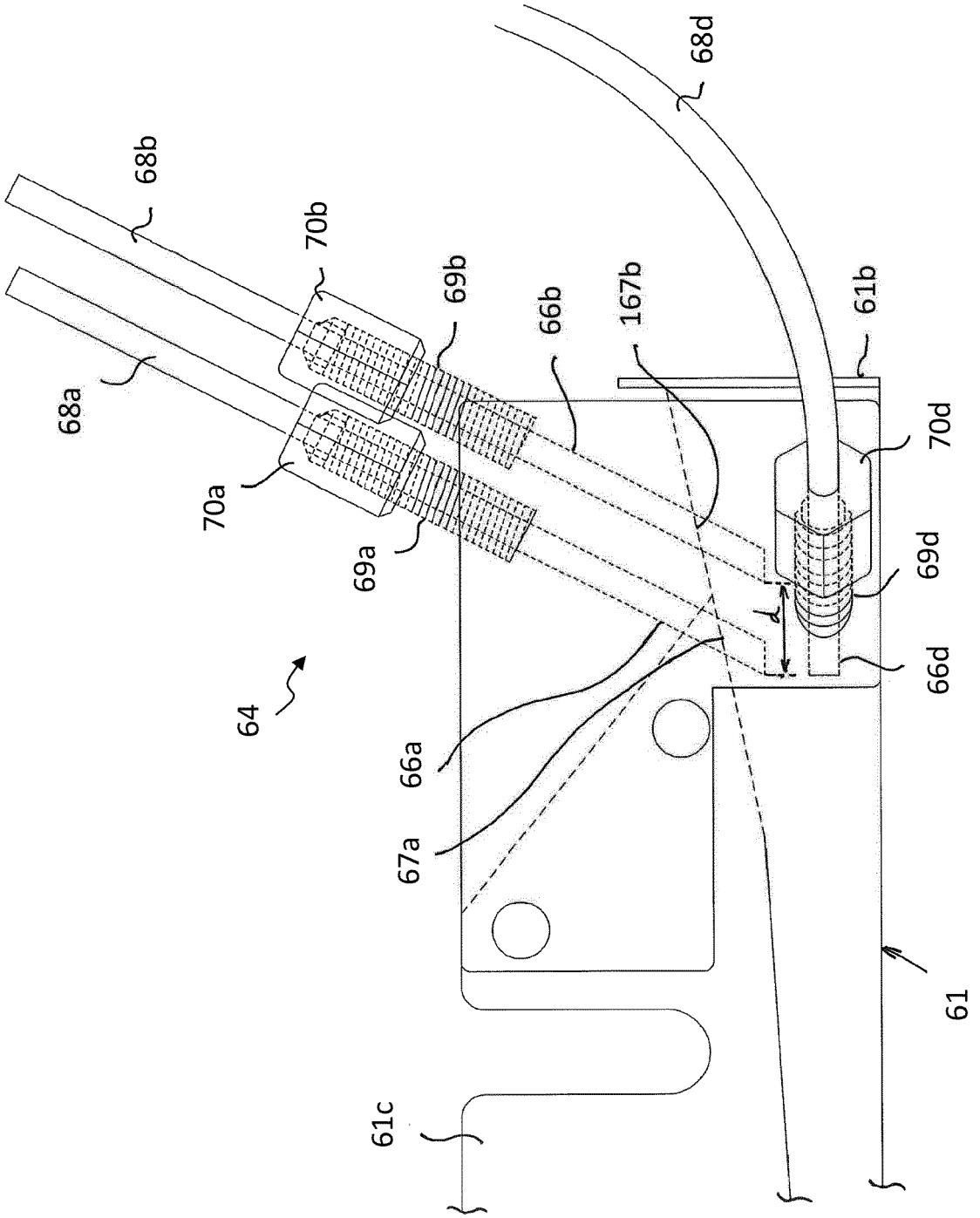
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Fig. 6

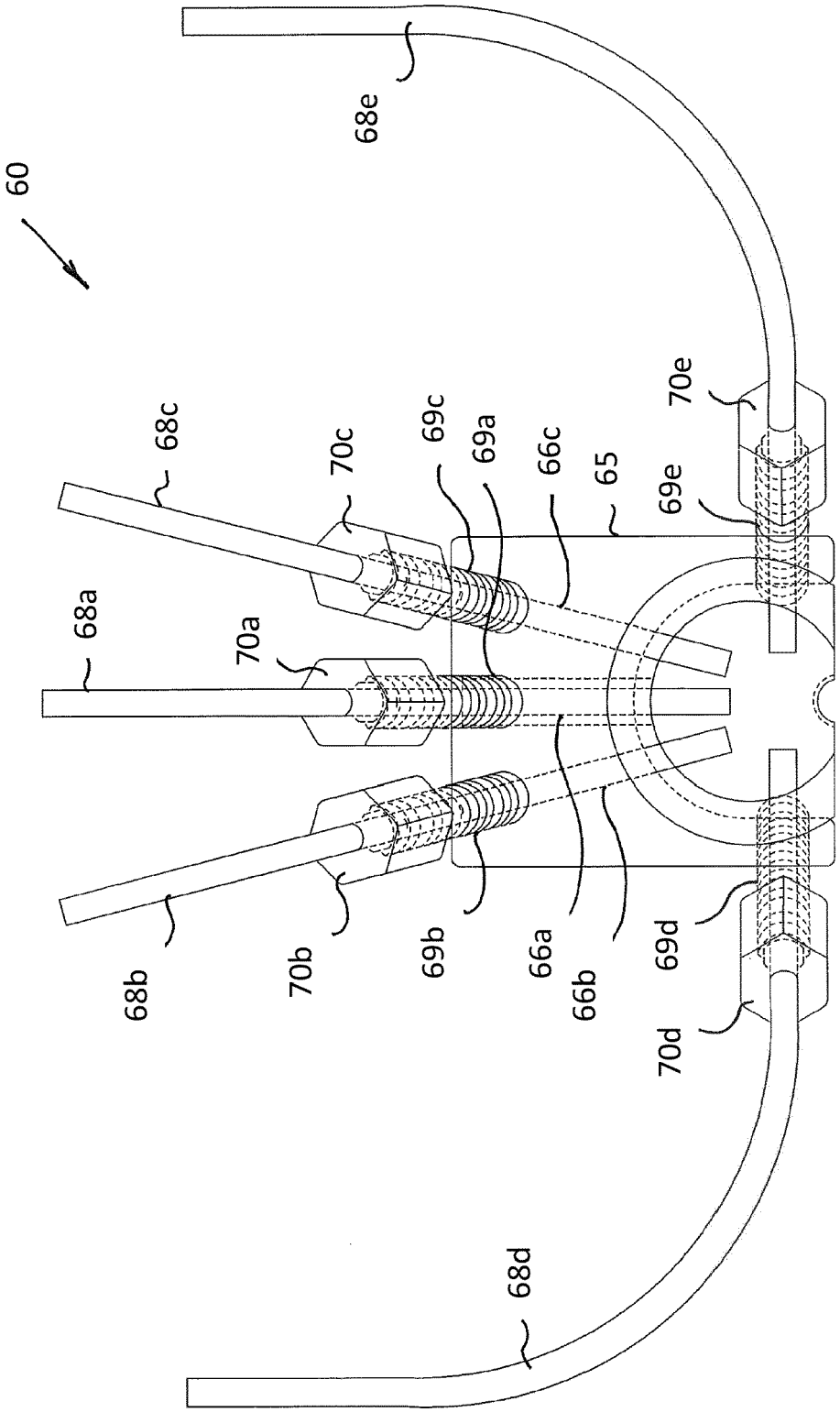
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Fig. 7

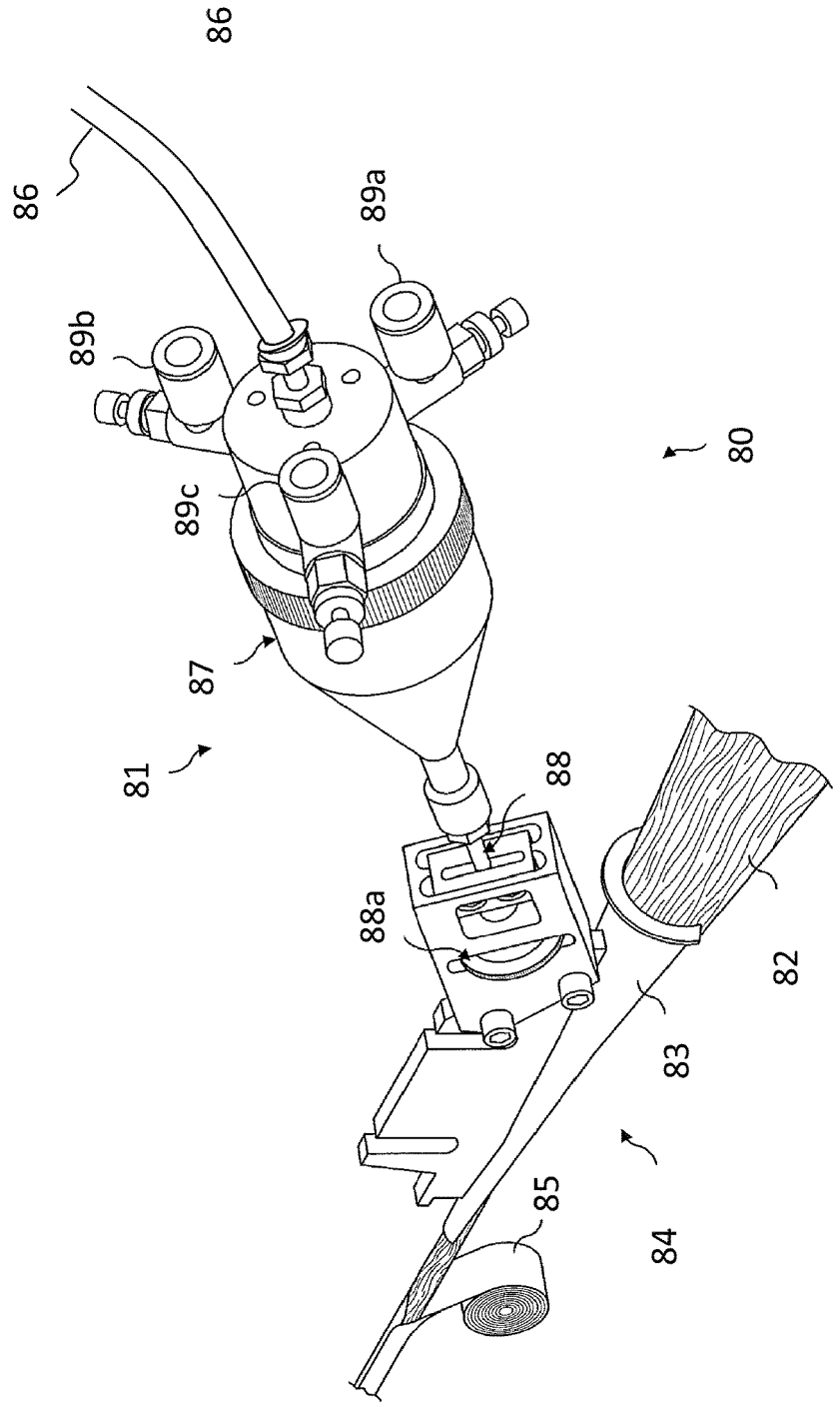


Fig. 8

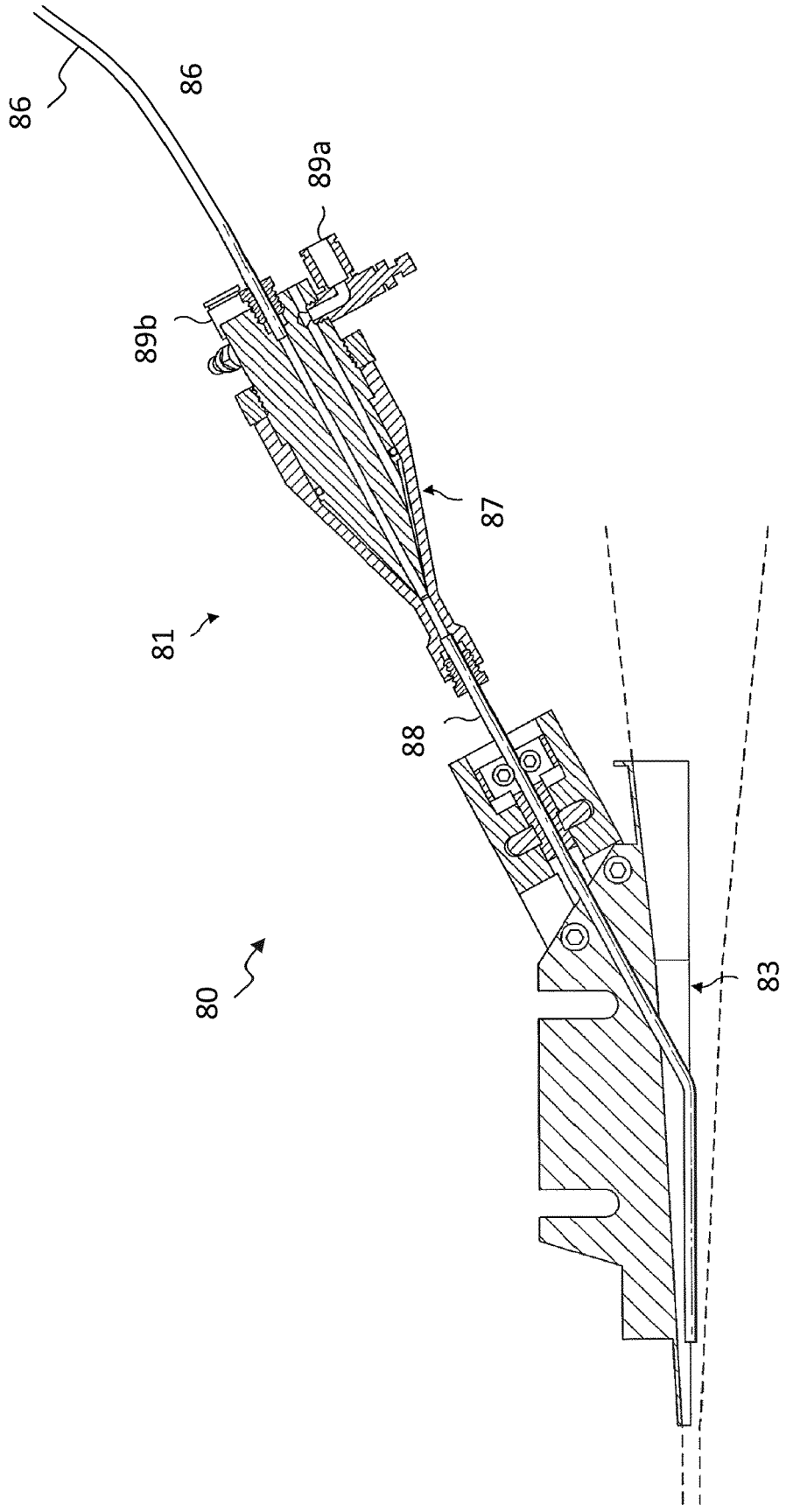


Fig. 9

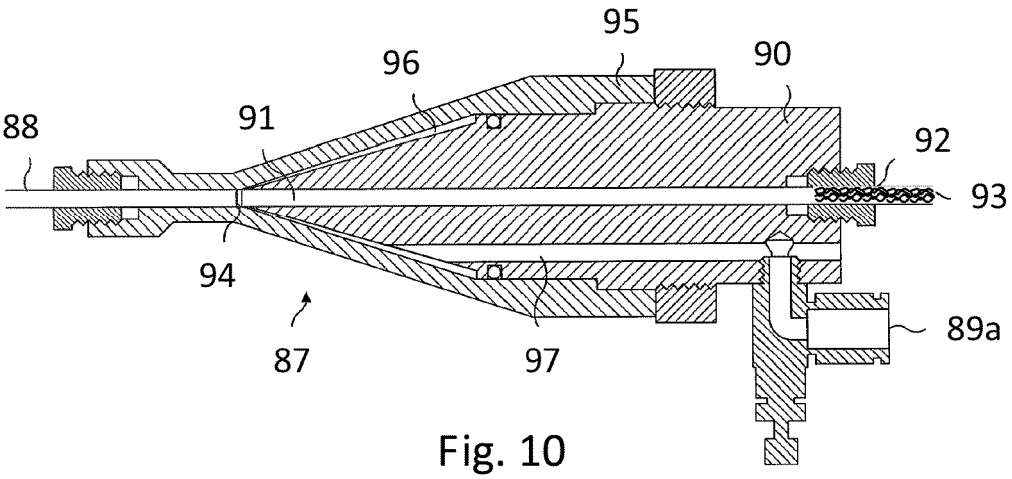


Fig. 10

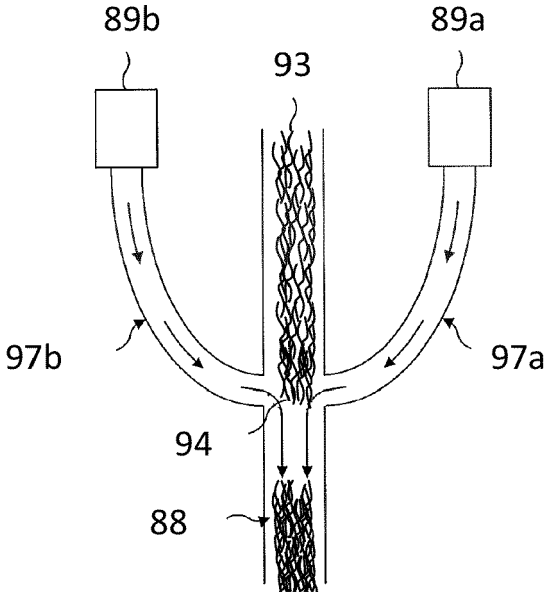


Fig. 11

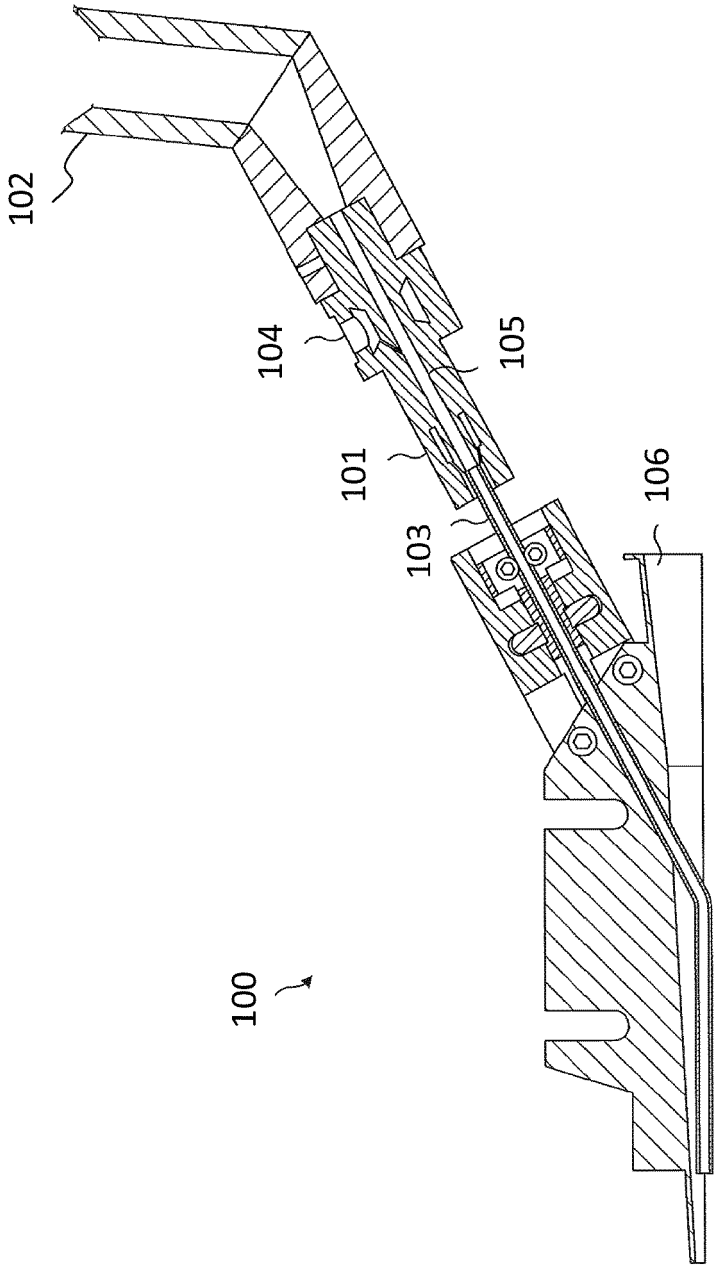
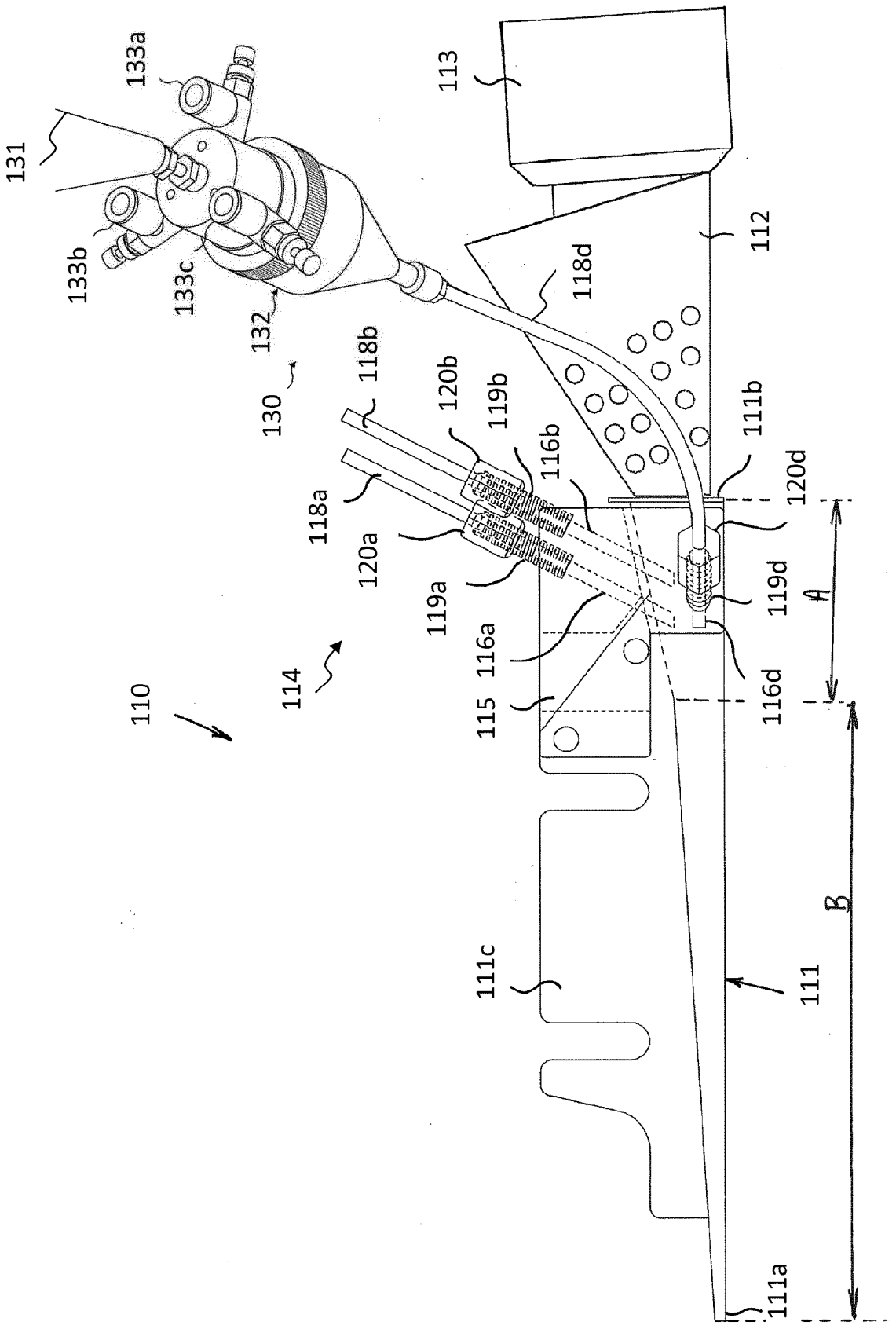


Fig. 12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A
116d
B
111c
111
111a

Fig. 13

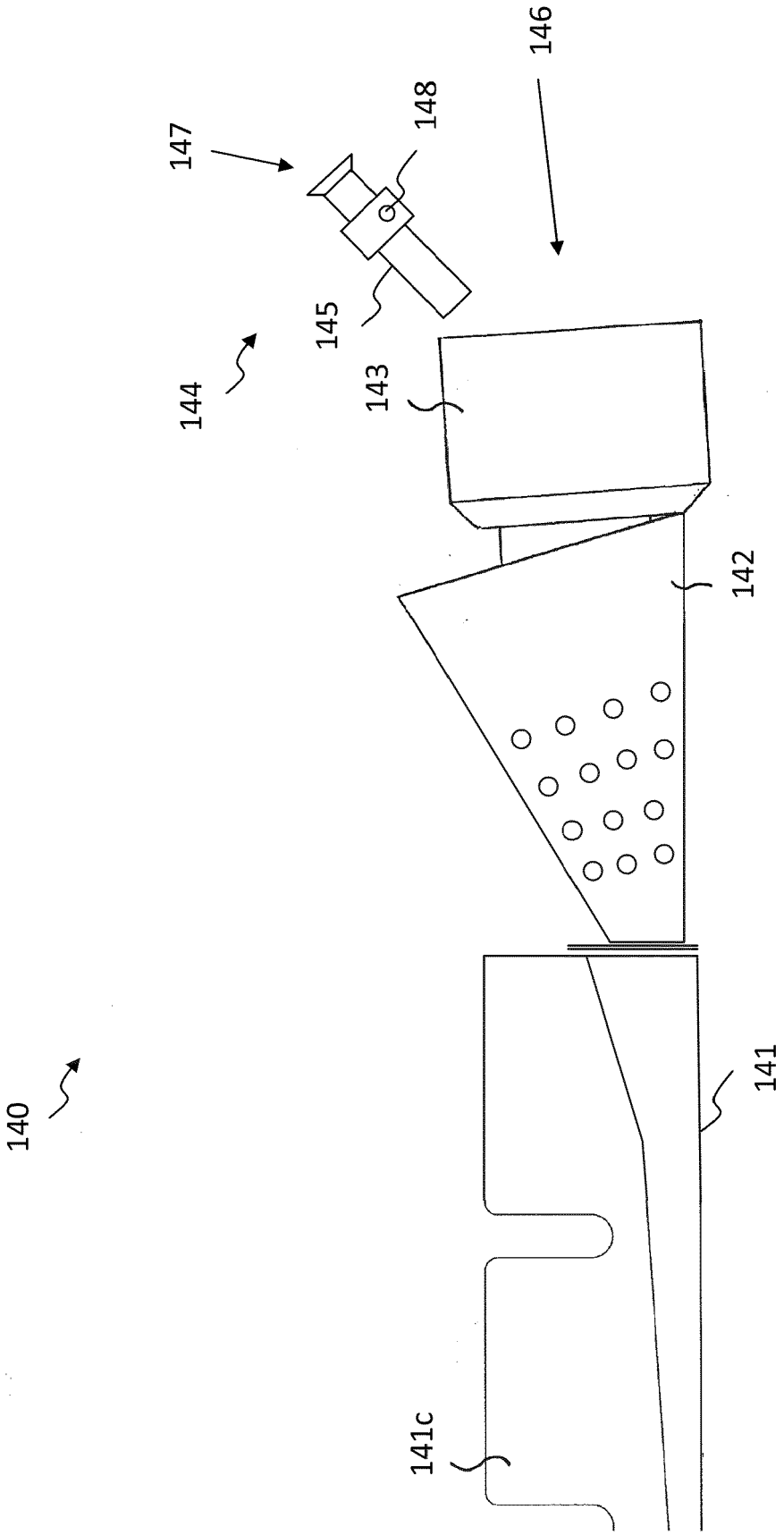

Fig. 14

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 May 2017	Marzano Monterosso

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