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(54) METHOD OF MANUFACTURING A FILTER ELEMENT FOR A SMOKING ARTICLE

VERFAHREN ZUR HERSTELLUNG EINES FILTERELEMENTS FÜR EINEN RAUCHARTIKEL

PROCÉDÉ DE FABRICATION D'UN ÉLÉMENT DE FILTRE POUR UN ARTICLE À FUMER

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Description

[0001] The present invention relates to a method of manufacturing or making a filter element for an aerosol generating product, such as a cigarette, a cigarillo, a cigar or the like, which for the sake of brevity will be generally referred to herein simply as a "smoking article". The invention also relates to a filter element obtained or manufactured by the inventive method, as well as an aerosol generating product, such as a smoking article, that includes such a filter element.

[0002] As will be appreciated, smoking articles such as cigarettes, cigarillos, cigars and the like are configured to generate an aerosol in the form of smoke for use by a consumer. For this reason, a smoking article is also more generally referred to as an "aerosol generating product" in this disclosure.

[0003] In the tobacco processing industry techniques are continually being developed for enhancing the production and performance of cigarettes and other smoking articles. For example, it is a continual goal of the industry to improve the manufacturing efficiency to lower costs and/or to increase productivity. Similarly, it is also a continual goal to improve the product itself from a point of view of consumer use. In view of the above, therefore, an object of this invention is to provide a new and/or improved method of manufacturing a filter element for an aerosol generating product, especially a smoking article, for the tobacco processing industry.

[0004] Smoking articles having perforated filter members with perforated wrapping materials are known from, for example, the documents FR 2 414 884 A, US 3 552 399 A, US 3 547 134 A, US 3 045 690 A, US 4 570 649 A or FR 2 545 696 A1.

[0005] In accordance with the invention, a method of manufacturing or making a filter element for aerosol generating products, such as smoking articles, as recited in claim 1 is provided. Advantageous and/or preferred features of the invention are recited in the dependent claims and are described below.

[0006] According to one aspect, therefore, the invention provides a method of manufacturing or producing a discrete or individual filter element for aerosol generating products, especially a filter plug element for smoking articles, comprising the steps:

> processing bulk filter material to provide or form a substantially continuous strand of the filter material;
> covering or wrapping the substantially continuous strand of the filter material with at least one layer of sheet material to form an elongate filter member, and forming perforations or holes in the elongate filter member by forming the perforations or holes in the at least one layer of sheet material and into or through the filter material covered or wrapped by the at least one layer of sheet material after the step of covering or wrapping the strand of filter material with the at least one layer of sheet material.

[0007] In this way, the invention provides a new and improved method or technique for forming or introducing holes or perforations in a filter element or filter "plug" of a smoking article. The perforations or holes formed in filter element or filter plug of a smoking article provide ventilation enabling air to be drawn laterally into the filter element and, thus, into a main flow or mainstream flow of the aerosol (e.g. smoke) that originates, in use, from an aerosol generating material (e.g. tobacco) of the smoking article. The lateral airflow mixes with the main axial flow of aerosol/smoke through the filter and causes more turbulence than laminar flow. This can result in increased filtration efficiency, and/or an easier pressure drop adjustment for the filter element. In the event that one or more flavour and/or indicator elements are provided in the filter plug or filter element, the airflow generated by the perforations or holes can produce a higher interaction or pick-up rate of flavour in the filter element by the mainstream smoke. Also, the perforations or holes can provide a capillary effect to distribute a flavouring liquid or an indicator liquid faster, thereby providing a faster or more efficient and homogeneous release of taste components to the mainstream aerosol/smoke. By forming the perforations or holes in the filter elements prior to manufacture or assembly of the smoking articles themselves, e.g. during the manufacture or production of the filter elements, the visibility of such perforations or holes otherwise formed through the outside of smoking articles and considered unsightly can be minimised and largely avoided.

[0008] According to the invention, the step of forming perforations or holes comprises forming those perforations or holes in the layer of sheet material that covers or wraps the elongate filter member. Where the step of forming the perforations or holes is performed or carried out after the step of covering or wrapping the strand of filter material with the layer of sheet material, the perforations or holes are not only formed through the layer of sheet material, but also into or through the filter material covered or wrapped by the at least one layer of sheet material. This not only ensures a good flow path for lateral airflow into the mainstream flow of smoke through the filter material, it also enhances the capillary effect for better distributing a flavouring liquid or an indicator liquid through the filter material.

[0009] In a preferred embodiment, each discrete or individual filter element is formed as a rod element or plug element of filter material, such as cellulose acetate tow or fibres, and is covered or wrapped or enclosed by at least one layer of sheet material, known as "plug wrap". This sheet material may be porous (e.g. paper) or non-porous (e.g. a plastic film or coated paper). Thus, the step of forming perforations or holes in the rod element of filter material then preferably comprises forming the perforations or holes in the at least one layer of sheet material, i.e. in the plug wrap, such that they communicate with the axial or mainstream flow of aerosol/smoke through the filter material within or enclosed by the plug

wrap. The individual filter rod elements or plug elements are typically produced by fabricating a continuous or long filter member and then cutting that elongate filter member into a plurality of shorter elements, each typically of uniform length. The fabrication of the continuous or long filter rod prior to cutting therefore preferably includes the step of forming a plurality of perforations or holes in the at least one layer of sheet material or plug wrap which is wrapped around and/or encloses the filter material, e.g. cellulose acetate tow or fibres, of the continuous or long filter rod. The discrete or individual plug elements or rod elements of filter material may then be subsequently cut from the elongate filter member.

[0010] The maintenance of tar, nicotine, and carbon monoxide (TNCO) levels with perforated tipping paper and plug wrap can be difficult. In particular, porosity change of tipping paper requires a long lead-time, which can generate write-off costs with old tipping paper stock. Furthermore, a change in the plug wrap or the pressure drop of the filter over time can also impact on cost, with inventory options for the plug wrap limited as well. The method of the invention addresses these issues with the potential to vary the number of perforations or holes and their respective depths to imitate variation in porosity of the plug wrap at constant cost. In this way, the ventilation of the filter element or plug can be varied with constant tipping paper porosity over a sufficient range for maintenance of the TNCO levels, thereby reducing the tipping paper inventories and write-offs.

[0011] In one preferred embodiment which does not belong to the present invention, the sheet material or plug wrap that covers or wraps the elongate filter member may be pre-perforated. In other words, the sheet material is perforated prior to the step of covering or wrapping the substantially continuous strand of filter material therewith.

[0012] In a preferred embodiment of the invention, the elongate filter member comprises either a generally continuous filter rod or a filter rod member of a predetermined length, and the method comprises: cutting the continuous filter rod or the filter rod member of predetermined length into a plurality of discrete or individual filter elements, with each discrete or individual filter element being configured for assembly with a respective tobacco rod element to form a smoking article. In this embodiment, the step of forming the perforations or holes in the layer of sheet material is performed or carried out before this cutting step. Accordingly, each discrete or individual filter element for an individual smoking article already has the perforations or holes for ventilation when it is produced or manufactured.

[0013] In a particularly preferred embodiment, the elongate filter member is a generally continuous filter rod and the method includes: cutting the continuous filter rod into a plurality of elongate rod members of a predetermined length. The step of forming the perforations or holes in the layer of sheet material or plug wrap that covers or wraps the strand of the filter material is then preferably carried out or performed on the elongate rod members of predetermined length. It will be noted, however, that the step of forming the perforations or holes in the layer of sheet material or plug wrap that covers or encloses the strand of the filter material may alternatively be carried out or performed on the continuous filter rod.

[0014] In a preferred embodiment of the invention, the perforations or holes are formed and/or arranged randomly in the layer of sheet material or plug wrap that covers or wraps the strand of the filter material. Alternatively, or in addition, the perforations or holes may be formed or arranged evenly or in an ordered arrangement in the layer of sheet material or plug wrap that covers or wraps the strand of the filter material. Preferably, the perforations or holes are distributed and/or formed around a periphery or circumference of the elongate filter member. Furthermore, the perforations or holes may be formed and/or distributed along a longitudinal extent of the elongate filter member.

[0015] In a preferred embodiment, the step of forming perforations or holes in the layer of sheet material or plug wrap that covers or wraps the strand of the filter material includes moving the elongate filter member relative to a perforating device or hole forming device; e.g. rotating the elongate filter member about a longitudinal axis thereof. Preferably, the perforating device or the hole forming device comprises at least one laser beam from a laser source, such as a pulsed or a continuous laser source, and more preferably multiple laser beams. Thus, the perforations or holes may be formed by means of at least one laser beam, which may ablate or cut and then penetrate or perforate the at least one layer of sheet material or plug wrap for communication with the mainstream flow through the filter material. By controlling the laser settings, round or cylindrical holes can be created having a minimum or predetermined small diameter and a controllable depth. The at least one laser beam is typically movable with respect to the element of filter material; for example, along a longitudinal direction and/or in a transverse direction with respect to the elongate filter member. By virtue of such relative movement, it becomes possible to generate a range of different patterns for the perforations or holes formed in the filter element.

[0016] In a preferred embodiment, the perforating device or hole forming device may include a beam splitter arrangement for generating multiple laser beams from a single laser source (e.g. a continuous or a pulsed laser source). In this regard, the beam splitter arrangement may include a prism and/or one or more mirrors. The beam splitter arrangement may preferably comprise a plurality of optical fibres to convey and direct respective individual laser beams towards the filter element from the laser source. Optical fibres are highly flexible and relatively inexpensive, and are therefore very practical for transmitting multiple laser beams. The ends of the optical fibres can be arranged in a predetermined array or pattern for transmitting the laser beams onto the elongate filter member. The optical fibres for the multiple laser

beams are therefore preferably directed towards and arranged around and/or along a length or extent of the elongate filter member for simultaneously forming a plurality of spaced perforations or holes in the filter member.

[0017] In a particularly preferred embodiment, the beam splitter arrangement includes an optical fibre support configured to receive and hold a free end of each of the optical fibres in such a way that the laser beam from each individual optical fibre is directed towards the longitudinal axis of the filter element. Thus, the optical fibre support may be configured to hold the optical fibres such that the laser beams are emitted therefrom in a plane generally perpendicular to a length or longitudinal axis of the element of filter material. This perpendicular orientation of the laser beams to the filter element thus forms straight cylindrical holes. Alternatively, or in addition, the optical fibre support may be configured to hold the optical fibres in such a way that the laser beams are emitted from the optical fibres to define a generatrix of a conical surface having its vertex on the longitudinal axis of the elongate filter member. With such an angled or oblique orientation of the laser beams to the filter member, inclined holes are formed.

[0018] According to another aspect, the present invention provides a filter element for an aerosol generating product, especially a filter plug element for a smoking article, manufactured or obtained by a method according to any one of the embodiments described above.

[0019] According to a further aspect, the present invention provides an aerosol generating product, especially a smoking article, comprising: an elongate rod element of an aerosol generating material, e.g. a tobacco rod, assembled with a filter element of the invention as described above.

[0020] In a preferred embodiment, the elongate element of an aerosol generating material is assembled with the filter element by arranging an end of the filter element (e.g. plug element) adjacent and/or abutting an end of the elongate element of aerosol generating material (e.g. tobacco rod element), and joining or fastening those elements together via at least one layer of sheet material or wrapper that covers or wraps the said elements at least in a region of their abutting ends. This at least one layer of sheet material or wrapper that joins or fastens the said elements together in the assembling step typically comprises paper, known as "tipping paper", although other materials may be contemplated. Because the filter element is perforated before assembly with the tobacco rod to form the smoking article, it also becomes possible to employ pre-perforated tipping paper with few perforations or holes which are barely visible or apparent to a consumer without a close inspection. This way, it becomes possible to eliminate formation of perforations or holes simultaneously through both the tipping paper and the plug wrap from the method of manufacturing the smoking article.

[0021] For a more complete understanding of the invention and the advantages thereof, exemplary embodiments of the invention are explained in more detail in the following description with reference to the accompanying drawing figures, in which like reference characters designate like parts and in which:

Fig. 1 is a schematic perspective view of a construction of a smoking article (e.g. cigarette) obtained by a method according to a preferred embodiment;

Fig. 2 is a schematic perspective view of a smoking article (e.g. cigarette) manufactured by a method according to a preferred embodiment;

Fig. 3 is a schematic side view of a production system for making a filter rod for use in manufacturing a smoking article;

Fig. 4 is a schematic side view of a filter rod produced for use in a method according to an embodiment of the invention;

Fig. 5 is a schematic side view of another filter rod for use in a method according to an embodiment of the invention; and

Fig. 6 is a flow diagram that schematically represents a method of an embodiment of the invention.

[0022] With reference to Figs. 1 and 2 of the drawings, the basic structure or construction of a smoking article 1 - in this case, a cigarette - according to a preferred embodiment is illustrated schematically. The smoking article 1 comprises an elongate, generally cylindrical rod element 2 of an aerosol generating material 3, especially a smoking material, such as tobacco, which is covered or wrapped with a layer 4 of sheet material in the form of cigarette paper. The layer or sheet 4 of cigarette paper is typically fixed around the body or mass of tobacco 3 via at least one fine line 5 of adhesive or glue applied in an overlap region 6 of the cigarette paper. In addition to rod element 2 of tobacco 3, the smoking article 1 comprises an elongate, generally cylindrical filter rod element or plug element 7 of a filter material 8, such as cellulose acetate tow, which is covered or wrapped with a layer 9 of sheet material commonly referred to as plug wrap. Again, the layer or sheet 9 of plug wrap is typically fixed around the body of filter material 8 via adhesive or glue 10 applied in an overlap region 11 of the plug wrap 9. Where the filter rod element or plug element 7 includes a breakable capsule of flavouring liquid and/or taste altering liquid embedded in the filter material 8, the sheet 9 of plug wrap may be selected to be non-porous to prevent uncontrolled transport or seepage of the liquid therethrough.

[0023] During fabrication or manufacture of the cigarette 1, the rod element 2 of tobacco 3 and the plug element 7 of filter material 8 are arranged substantially in alignment such that an end 12 of the tobacco rod element 2 is adjacent to and/or in abutment with an end 13 of the filter plug element 7. One or more layer 14 of a paper sheet or wrapper, commonly known as tipping paper, is then used to join or fasten the tobacco rod element 2 and

the filter plug element 7 together. In this regard, the layer 14 of tipping paper covers or wraps those elements 2, 7 in a region of their abutting ends 12, 13 and is fixed to each of the tobacco rod element 2 and the filter plug element 7 via a fine line 15 of adhesive or glue applied along an edge region 16 of the layer 14. The layer or sheet 14 of tipping paper typically fully covers the filter plug element 7, as seen in Fig. 1.

[0024] Referring further to Fig. 1, it can be seen that according to the method of fabrication or manufacture of the cigarette 1, both the plug of filter material 8 and the layer 9 of sheet material or plug wrap around the filter material 8 of the filter plug element 7 have an ordered array of perforations or holes 17 formed therein before the tobacco rod element 2 and the filter plug element 7 are assembled and joined together with the layer or sheet 14 of tipping paper. Although the layer 9 of plug wrap can be seen to include the perforations or holes 17 before the layer 9 is wrapped around the cylindrical body of filter material 8, this view simply illustrates the construction of the filter element 7 and need not necessarily be the case. In practice, the perforations or holes 17 may also be formed in the layer 9 of plug wrap after that layer 9 has been wrapped and fixed around the body of filter material 8 during fabrication of the plug element 7. As seen in Fig. 1, the perforations or holes 17 are formed or arranged in rows which extend around a circumference of the filter plug element 7 in a central region thereof.

[0025] Because the layer 9 of plug wrap in the filter plug element 7 is already perforated with holes 17 when that filter element 7 is combined and assembled with the tobacco rod element 2, it is possible to use a pre-perforated layer 14 of tipping paper when joining or fastening those two elements 2, 7 of the cigarette 1. In this regard, the pre-perforated layer 14 of tipping paper will usually have a relatively small number of perforations or holes 18 so that these are not visible or apparent to a consumer without very close inspection. These perforations or holes 18 in the layer 14 of tipping paper are nevertheless sufficient to allow a lateral influx of air into the filter plug element 7 through the perforations or holes 17 in the layer 9 of plug wrap. By employing pre-perforated tipping paper, it is also possible to eliminate the need to form perforations or holes through both the tipping paper and the plug wrap simultaneously from the method of manufacturing the smoking article. As can be seen in Fig. 2, the layer 14 of tipping paper effectively hides or obscures the holes or perforations 17 in the layer 9 of plug wrap and only a single fine row or line of perforations or holes 18 is visible on close inspection by a consumer. When a consumer draws on a proximal end of the filter element 7 in use, an axial flow or mainstream flow 19 of an aerosol or smoke S from the tobacco 3 is drawn longitudinally of and within the smoking article 1 and through the filter element 7 (i.e. in a direction of the arrow). At the same time, an air-flow is also drawn laterally through the perforations or holes 17, 18 and this lateral air flow mixes with the mainstream flow 19 to create turbulence and a more convoluted flow path through the filter element 7. With reference to Figs. 3 to 5 of the drawings, the step of forming the perforations or holes 17 in the filter element 7, and particularly in the plug of filter material 8 and the layer 9 of sheet material or plug wrap around the filter material 8, may be performed during fabrication of the filter element 7. In this regard, the discrete or individual filter rod elements 7 are cut from a continuous filter rod R or from long filter rod members 20 (e.g. as shown schematically in Figs. 4 and 5) which are typically fabricated or produced in a dedicated filter making apparatus or machine 30 shown schematically in Fig. 3 of the drawings for manufacture of standard crimped cellulose acetate filters commonly used in the tobacco industry. It should be noted, however, that the step of perforating holes in the filter plug element 7, and especially in the layer 9 of plug wrap, could likewise be implemented in filter rod elements 7 produced with randomly oriented fibres of cellulose acetate, such as obtained from TURMALIN filter maker from the German manufacturer HAUNI.

[0026] In a first stage A of the filter making procedure, the filter material 8, comprising cellulose acetate tow, is treated and prepared. Firstly, the filter tow 8 is drawn in a generally continuous strand or ribbon D from a bulk supply 8', such as bale, and then conveyed through a series of banding jets 31, 31', 31", pre-tension rollers 32, and a blooming roller 33. In this first phase A, the filter tow 8 is stretched and relaxed to create a maximum surface area in the fibres of the cellulose acetate. In a second stage B of the filter making procedure, the generally continuous strand or ribbon D of filter tow 8 passes through a plasticiser addition unit 34, in which a plasticiser such as a triacetin is added to the fibres (e.g. by spraying) to enhance their adhesion together. At an exit of the plasticiser addition unit 34, the filter tow 8 passes through delivery rollers 35 into a third, rod-making stage C of the filter making procedure. At this position, the strand of filter tow fibres 8 is channelled via a guide device 36, especially a trumpet guide having a so-called "stuffer jet" or transport jet 36', to form or provide the substantially continuous strand D of filter tow material 8 with the desired circular cross-sectional shape. At this stage, a capsule, pellet or thread of flavouring material (with or without indicator) may also be introduced into the strand D of filter material 8. At the same time, a sheet or layer 9 of plug wrap material is drawn from a bulk roll 37 and fed via rollers up to the tow fibre strand D.

[0027] An adhesive is typically applied to the layer 9 of plug wrap material via an applicator nozzle 38 as that layer 9 of plug wrap material is brought into contact with and wrapped around the strand of filter material 8. This adhesive, which usually bonds or fixes the plug wrap 9 to the filter material 8, may be applied to the plug wrap material 9 as a single line or as multiple lines of adhesive, and may follow either straight or non-linear application patterns (circular, wavy or curly, for example). To seal the plug wrap 9 over or around the rod-like strand D of filter material 8 formed in the guide device 36, a seam

line 10 of glue is preferably applied to an overlap region 11 of the plug wrap 9 at an outlet of the guide device 36. In some cases, however, such seam lines may be deposited at the same time as the attachment glue at nozzle 38.

[0028] The continuous filter rod R that is thereby formed comprising the strand D of filter material 8 now covered with the layer 9 of plug wrap then passes through a sealing chamber 39 to seal and bond the wrapped rod R in its final desired shape. The layer 9 of plug wrap sheet material which is wrapped around and covers the filter tow 8 assists in maintaining a desired cylindrical form of the filter rod. Upon emerging from the sealing chamber 39, the continuous rod R of filter material 8 is inspected at an inspection station 41 and then conveyed to a cutting station 42 where it is cut into predetermined lengths of rod members 20, e.g. as shown in Figs. 4 and 5, each of which then undergoes a perforating or hole forming step in a hole-forming device 40.

[0029] The perforating or hole forming device 40 comprises a laser source for generating a laser beam, and a beam splitter for splitting the single laser beam from the laser into multiple laser beams. The beam splitter of the perforating device 40 includes a plurality of optical fibres, each of which is configured and arranged to convey and direct individual laser beams towards the filter rod members 20. In this regard, the optical fibres are mounted within a support that holds a free end of each of the optical fibres arranged in a row or array directed at and arranged around and/or along an extent of the rod members 20. In this way, the multiple laser beams emitted from the ends of the individual optical fibres are directed towards a longitudinal axis of the filter rod member 20 and can simultaneously cut or burn a plurality of perforations or holes 17 (e.g. preferably evenly spaced) through the layer 9 of plug wrap around the rod members 20. By controlling the laser settings, such as power and operation time, it is also possible to control parameters, e.g. depth, of the holes 17 formed. Indeed, it is desired that the perforations or holes 17 not only penetrate the layer(s) 9 of plug wrap around the filter material 8, but also penetrate through the fibres of the filter tow 8 towards the middle of the rod members 20. The optical fibre support may be movable with respect to the filter rod members 20 to generate the desired constellation of perforations or holes 17, and/or more preferably the filter rod members 20 may be movable with respect to the support; e.g. in the longitudinal direction and/or in rotation about their longitudinal axes.

[0030] As seen in Fig. 4, the perforations or holes 17 formed in the filter rod members 20 (and thus in each of filter element 7) may be arranged in a regular or ordered, densely packed array around a circumference of the filter rod member 20 and along a length thereof. In an alternative embodiment in Fig. 5, the perforations or holes 17 formed in the filter rod members 20 may be arranged in series of single circumferential rows 21 evenly spaced apart along the filter rod member 20 such that each filter element 7 cut from the filter rod member 20 has a single circumferential row 21 of those perforations or holes 17. In a further alternative discussed above with respect to Fig. 1, each filter element 7 may include a series of rows 21 of the perforations or holes 17, e.g. circumferentially in a particular region thereof.

[0031] The perforations or holes 17, which are formed in the layer or sheet 9 of plug wrap around the tow material 8 and extend into the filter plug elements 7, can act as capillaries or pathways to assist transportation of flavouring liquids from capsules along and through the filter elements 7. They can thus assist the activation of indicators and faster distribution in the filter element 7 for release to the axial or mainstream smoke 19. In addition, lateral air-flow through the perforations or holes 17 causes a more turbulent flow of smoke through the filter element 7 which facilitates pick-up of more flavour molecules into mainstream smoke 19. Forming the perforations or holes 17 in the plug wrap layer 9 is also able to flexibly mimic porous plug wrap material with the number and extent of perforation effectively varying porosity for pre-perforated tipping paper products.

[0032] After the perforating or hole forming procedure in the hole-forming device 40, the rod members 20 may again be inspected at an inspection station 41 and then conveyed via a conveyor device 43 either to a storage buffer 44 or to another cutting station where the rod members 20 are cut to individual filter elements 7, which are then stored in a storage buffer.

[0033] With reference now to Fig. 6 of the drawings, the method of manufacturing a filter plug element 7 for a smoking article 1 according to the invention is illustrated schematically, with the numbered boxes I to IV of the diagram representing steps of the method. In particular, the first box I represents the step of providing a bulk supply 8' of a filter material, such as cellulose acetate tow, for processing as shown in Fig. 3. The second box II represents the step of processing the bulk filter material 8 to form a substantially continuous strand D of the filter material 8, which is preferably treated, guided and shaped to have a generally cylindrical cross-section. The third box III of the diagram in Fig. 6 then represents the step of covering (e.g. wrapping) the substantially continuous strand D of the filter material 8 with at least one layer 9 of sheet material or plug wrap to form an elongate filter member, which may be a generally continuous filter rod R or an elongate filter rod member 20 of predetermined length. The fourth box IV represents the step of forming perforations or holes 17 in the layer 9 of sheet material or plug wrap that covers the elongate filter member R, 20 before and/or after the step of covering the strand D of filter material 8. In this regard, the layer 9 of sheet material on the roll 37 may be pre-perforated. Alternatively, or in addition, the step of forming the perforations or holes 17 in the layer 9 of sheet material or plug wrap may be carried out or performed on the elongate filter member R, 20 before it is cut to produce a plurality of the discrete or individual filter elements 7 for individual

smoking articles 1.

List of Reference Signs

[0034]

1	smoking article
2	elongate element of tobacco or tobacco rod element
3	aerosol generating material or tobacco
4	layer of sheet material or cigarette paper
5	line of adhesive or glue
6	overlap region of cigarette paper
7	elongate element or plug element of filter material
8	filter material or cellulose acetate tow
8'	supply or bale of filter material
9	layer of sheet material or plug wrap
10	line of adhesive or glue
11	overlap region of plug wrap
12	end of tobacco rod element
13	end of filter plug element
14	layer or sheet of material or tipping paper
15	line of adhesive or glue
16	edge region of the layer or sheet of tipping paper
17	perforation or hole in the layer of plug wrap
18	perforation or hole in the layer of tipping paper
19	axial flow or mainstream flow of aerosol or smoke
20	filter rod member
21	row of holes or perforations
30	filter making apparatus or machine
31	banding jet
31'	banding jet
31"	banding jet
32	pre-tension roller
33	blooming roller
34	plasticiser addition unit
35	delivery roller
36	guide device or trumpet guide
36'	transport jet or "stuffer" jet
37	bulk roll
38	applicator nozzle
39	sealing chamber
40	perforating device or hole-forming device
41	inspection station for rod measurement/inspection
42	cutting station
43	conveyor device for filter elements or rod members
44	storage buffer
S	aerosol or smoke
D	strand of filter material
R	continuous filter rod

Claims

1. A method of manufacturing filter elements (7) for aerosol generating products (1), especially filter plug elements (7) for smoking articles, comprising:

processing bulk filter material (8) to provide or form a substantially continuous strand (D) of the filter material (8); and
covering the substantially continuous strand (D) of filter material (8) with at least one layer (9) of sheet material to form an elongate filter member (R, 20);
the method comprising the step of forming perforations or holes (17) in the elongate filter member (R, 20) by forming the perforations or holes (17) in the at least one layer (9) of sheet material and into or through the filter material (8) covered or wrapped by the at least one layer (9) of sheet material after the step of covering the strand (D) of filter material (8) with the at least one layer (9) of sheet material, **characterized in that** the method is a method of manufacturing discrete or individual filter elements (7).

2. A method according to claim 1, wherein the elongate filter member (R, 20) comprises a substantially continuous filter rod (R) or a filter rod member (20) of predetermined length, and wherein the method comprises: cutting the continuous filter rod (R) or the filter rod member (20) of predetermined length into a plurality of discrete or individual filter elements (7), each of which is configured to be assembled with a respective rod element (2) of aerosol generating material (3), such as tobacco, to form a smoking article (1), wherein the step of forming the perforations or holes (17) in the layer (9) of sheet material is carried out before the cutting step.

3. A method according to 2. claim 1, wherein the elongate filter member (R, 20) comprises a continuous filter rod (R), wherein the method comprises:
cutting the continuous filter rod (R) into a plurality of elongate rod members (20) of predetermined length, wherein the step of forming perforations or holes (17) in the layer (9) of sheet material is carried out or performed on the elongate rod members (20).

4. A method according to any one of the preceding claims, wherein the perforations or holes (17) are formed or arranged randomly in the layer (9) of sheet material, or wherein the perforations or holes (17) are formed or arranged evenly or regularly in said layer (9).

5. A method according to any one of the preceding claims, wherein the perforations or holes (17) are arranged or formed around a circumference of the continuous filter rod (R) or the elongate rod members (20), and/or wherein the perforations or holes (17) are arranged or formed longitudinally along the continuous filter rod (R) or the elongate rod members

(20).

6. A method according to any one of the preceding claims, wherein the step of forming perforations or holes (17) in the layer (9) of sheet material includes moving the continuous filter rod (R) or the elongate rod members (20) relative to a perforating device or a hole forming device (40), preferably rotating the filter rod (R) or the elongate rod members (20) about a longitudinal axis thereof.

7. A method according to any one of the preceding claims, wherein the step of forming perforations or holes (17) includes irradiating the layer (9) of sheet material with at least one laser beam, whereby the perforations or holes (17) are formed by means of the at least one laser beam.

8. A method according to claim 7, wherein the at least one laser beam is movable with respect to the filter rod (R) or filter rod members (20), preferably movable along a longitudinal direction and/or in a transverse direction with respect thereto.

9. A method according to any one of the preceding claims, wherein a perforating device or hole forming device (40) comprises a laser source, a beam splitter arrangement for generating multiple laser beams from said laser source, a plurality of optical fibres for conveying and directing a respective laser beam towards the filter rod (R) or the filter rod members (20), and an optical fibre support configured to receive and hold a free end of each of the optical fibres in such a way that the laser beams from each individual optical fibre are arranged adjacent and directed towards the layer (9) of sheet material which covers the filter rod (R) or the filter rod members (20).

10. A method according to any one of the preceding claims, further comprising the step of:

cutting the elongate filter member (R, 20) into a plurality of discrete or individual filter elements (7), each of which is configured for assembly with an element (2) of aerosol generating material (3), especially a rod element of tobacco;
wherein the filter material (8) comprises cellulose acetate tow and wherein the layer (9) of sheet material is porous or non-porous, preferably comprising paper.

Patentansprüche

1. Verfahren zur Herstellung von Filterelementen (7) für aerosolgenerierende Produkte (1), insbesondere Filterstückelementen (7) für Rauchartikel, umfassend:

Verarbeiten von Massenfiltermaterial (8), um einen im Wesentlichen kontinuierlichen Strang (D) des Filtermaterials (8) bereitzustellen oder zu bilden; und
Bedecken des im Wesentlichen kontinuierlichen Strangs (D) von Filtermaterial (8) mit mindestens einer Schicht (9) eines Bahnmaterials, um ein längliches Filterelement (R, 20) zu bilden;
wobei das Verfahren den Schritt umfasst, Perforationen oder Löcher (17) in dem länglichen Filterelement (R, 20) zu bilden, indem die Perforationen oder Löcher (17) in der mindestens einen Schicht (9) eines Bahnmaterials und in oder durch das Filtermaterial (8), das durch die mindestens eine Schicht (9) eines Bahnmaterials bedeckt oder umhüllt wird, nach dem Schritt des Bedeckens des Strangs (D) von Filtermaterial (8) mit der mindestens einen Schicht (9) eines Bahnmaterials ausgebildet werden, **dadurch gekennzeichnet, dass** das Verfahren ein Verfahren zur Herstellung diskreter oder individueller Filterelemente (7) ist.

2. Verfahren nach Anspruch 1, wobei das längliche Filterelement (R, 20) einen im Wesentlichen kontinuierlichen Filterstab (R) oder ein Filterstabelement (20) einer zuvor festgelegten Länge umfasst, und wobei das Verarbeiten Folgendes umfasst:
Schneiden des kontinuierlichen Filterstabes (R) oder des Filterstabelements (20) von zuvor festgelegter Länge in mehrere diskrete oder individuelle Filterelemente (7), von denen jedes dafür ausgebildet ist, mit einem jeweiligen Stabelement (2) aus aerosolerzeugendem Material (3), wie beispielsweise Tabak, zu einem Rauchartikel (1) zusammengesetzt zu werden, wobei der Schritt des Bildens der Perforationen oder Löcher (17) in der Schicht (9) aus Bahnmaterial vor dem Schneideschritt durchgeführt wird.

3. Verfahren nach Anspruch 1, wobei das längliche Filterelement (R, 20) einen kontinuierlichen Filterstab (R) umfasst, wobei das Verarbeiten Folgendes umfasst: Schneiden des kontinuierlichen Filterstabes (R) in mehrere längliche Stabelemente (20) von zuvor festgelegter Länge, wobei der Schritt des Bildens von Perforationen oder Löchern (17) in der Schicht (9) aus Bahnmaterial an den länglichen Stabelementen (20) durch- oder ausgeführt wird.

4. Verfahren nach einem der vorangehenden Ansprüche, wobei die Perforationen oder Löcher (17) zufällig in der Schicht (9) aus Bahnmaterial ausgebildet oder angeordnet sind, oder wobei die Perforationen oder Löcher (17) gleichmäßig oder regelmäßig in der Schicht (9) ausgebildet oder angeordnet sind.

5. Verfahren nach einem der vorangehenden Ansprüche, wobei die Perforationen oder Löcher (17) um

einen Umfang des kontinuierlichen Filterstabes (R) oder der länglichen Stabelemente (20) herum angeordnet oder ausgebildet sind, und/oder wobei die Perforationen oder Löcher (17) in Längsrichtung entlang des kontinuierlichen Filterstabes (R) oder der länglichen Stabelemente (20) angeordnet oder ausgebildet sind.

6. Verfahren nach einem der vorangehenden Ansprüche, wobei der Schritt des Bildens von Perforationen oder Löchern (17) in der Schicht (9) aus Bahnmaterial das Bewegen des kontinuierlichen Filterstabes (R) oder der länglichen Stabelemente (20) relativ zu einer Perforationsvorrichtung oder einer Lochbildungsvorrichtung (40) umfasst, vorzugsweise das Drehen des Filterstabes (R) oder der länglichen Stabelemente (20) um eine Längsachse derselben.

7. Verfahren nach einem der vorangehenden Ansprüche, wobei der Schritt des Bildens von Perforationen oder Löchern (17) das Bestrahlen der Schicht (9) aus Bahnmaterial mit mindestens einem Laserstrahl umfasst, wodurch die Perforationen oder Löcher (17) mit dem mindestens einen Laserstrahl gebildet werden.

8. Verfahren nach Anspruch 7, wobei der mindestens eine Laserstrahl relativ zu dem Filterstab (R) oder den Filterstabelementen (20) beweglich ist, vorzugsweise entlang einer Längsrichtung und/oder in einer Querrichtung relativ dazu.

9. Verfahren nach einem der vorangehenden Ansprüche, wobei eine Perforationsvorrichtung oder Lochbildungsvorrichtung (40) umfasst: eine Laserquelle, eine Strahlteileranordnung zum Erzeugen mehrerer Laserstrahlen aus der Laserquelle, mehrere Lichtleitfasern zum Transportieren und Richten eines jeweiligen Laserstrahls auf den Filterstab (R) oder die Filterstabelemente (20) und einen Lichtwellenleiterträger, der dafür ausgebildet ist, ein freies Ende jeder der Lichtleitfasern so aufzunehmen und zu halten, dass die Laserstrahlen von jeder einzelnen Lichtleitfaser neben und in Richtung der Schicht (9) aus Bahnmaterial, die den Filterstab (R) oder die Filterstabelemente (20) bedeckt, angeordnet sind.

10. Verfahren nach einem der vorangehenden Ansprüche, des Weiteren umfassend folgenden Schritt:

Schneiden des langgestreckten Filterelements (R, 20) in mehrere diskrete oder individuelle Filterelemente (7), von denen jedes zur Montage an einem Element (2) aus aerosolerzeugendem Material (3), insbesondere einem Stabelement aus Tabak, ausgebildet ist;
wobei das Filtermaterial (8) Celluloseacetatwerg umfasst, und
wobei die Schicht (9) aus Bahnmaterial porös oder nichtporös ist und vorzugsweise Papier umfasst.

Revendications

1. Procédé de fabrication d'éléments filtrants (7) pour des produits générateurs d'aérosols (1), en particulier des éléments de bout-filtre (7) pour des articles à fumer, comprenant de :

traiter un matériau filtrant en vrac (8) pour fournir ou former un brin sensiblement continu (D) du matériau filtrant (8) ; et
recouvrir le brin sensiblement continu (D) de matériau filtrant (8) avec au moins une couche (9) de matériau de feuille pour former un élément filtrant allongé (R, 20);
le procédé comprenant l'étape consistant à former des perforations ou des trous (17) de l'élément filtrant allongé (R, 20) en formant des perforations ou des trous (17) dans la au moins une couche (9) de matériau de feuille et dans ou à travers le matériau filtrant (8) recouvert ou enveloppé par la au moins une couche (9) de matériau de feuille après l'étape de recouvrement du brin (D) de matériau filtrant (8) avec la au moins une couche (9) de matériau de feuille, **caractérisé en ce que** le procédé est un procédé de fabrication d'éléments filtrants séparés ou individuels (7).

2. Procédé selon la revendication 1, dans lequel l'élément filtrant allongé (R, 20) comprend une tige de filtre sensiblement continue (R) ou un élément de tige de filtre (20) de longueur prédéterminée, et dans lequel le procédé comprend de : découper la tige de filtre continue (R) ou l'élément de tige de filtre (20) de longueur prédéterminée en une pluralité d'éléments filtrants séparés ou individuels (7), dont chacun est configuré pour être assemblé avec un élément de tige respectif (2) de matériau générateur d'aérosol (3), tel que du tabac, pour former un article à fumer (1), dans lequel l'étape de formation des perforations ou des trous (17) dans la couche (9) de matériau de feuille est effectuée avant l'étape de découpe.

3. Procédé selon la revendication 1, dans lequel l'élément filtrant allongé (R, 20) comprend une tige de filtre continue (R), dans lequel le procédé comprend de : découper la tige de filtre continue (R) en une pluralité d'éléments de tige allongés (20) de longueur prédéterminée, dans lequel l'étape consistant à former des perforations ou des trous (17) dans la couche (9) de matériau de feuille est exécutée ou effectuée sur les éléments de tige allongés (20).

4. Procédé selon l'une quelconque des revendications précédentes, dans lequel les perforations ou les trous (17) sont formés ou disposés de façon aléatoire dans la couche (9) de matériau de feuille, ou dans lequel les perforations ou les trous 17) sont formés ou disposés de façon uniforme ou régulière dans ladite couche (9).

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel les perforations ou les trous (17) sont disposés ou formés sur d'une circonférence de la tige de filtre continue (R) ou les éléments de tige allongés (20), et/ou dans lequel les perforations ou les trous (17) sont disposés ou formés longitudinalement le long de la tige de filtre continue (R) ou les éléments de tige allongés (20).

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'étape consistant à former des perforations ou des trous (17) dans la couche (9) de matériau de feuille comprend de déplacer la tige de filtre continue (R) ou les éléments de tige allongés (20) par rapport à un dispositif de perforation ou un dispositif de formation de trous (40), de préférence en faisant tourner la tige de filtre (R) ou les éléments de tige allongés (20) autour d'un axe longitudinal de ceux-ci.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'étape consistant à former des perforations ou des trous (17) comprend d'irradier la couche (9) de matériau de feuille avec au moins un faisceau laser, moyennant quoi les perforations ou les trous (17) sont formés au moyen du au moins un faisceau laser.

8. Procédé selon la revendication 7, dans lequel le au moins un faisceau laser est mobile par rapport à la tige de filtre (R) ou aux éléments de tige de filtre (20), de préférence mobile le long d'une direction longitudinale et/ou dans une direction transversale par rapport à ceux-ci.

9. Procédé selon l'une quelconque des revendications précédentes, dans lequel un dispositif de perforation ou un dispositif de formation de trous (40) comprend une source laser, un agencement de séparateur de faisceau destiné à générer de multiples faisceaux laser à partir de ladite source laser, une pluralité de fibres optiques pour transporter et diriger un faisceau laser respectif vers la tige de filtre (R) ou les éléments de tige de filtre (20), et un support de fibre optique configuré pour recevoir et maintenir une extrémité libre de chacune des fibres optiques de telle manière que les faisceaux laser provenant de chaque fibre optique individuelle sont agencés adjacents et orientés vers la couche (9) de matériau de feuille qui recouvre la tige de filtre (R) ou les éléments de tige de filtre (20).

10. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape consistant à :

découper l'élément filtrant allongé (R, 20) en une pluralité d'éléments filtrants séparés ou individuels (7), dont chacun est configuré pour être assemblé avec un élément (2) de matériau générateur d'aérosol (3), en particulier un élément de tige de tabac;
dans lequel le matériau filtrant (8) comprend une mèche d'acétate de cellulose et dans lequel la couche (9) de matériau de feuille est poreuse ou non poreuse, comprenant de préférence du papier.

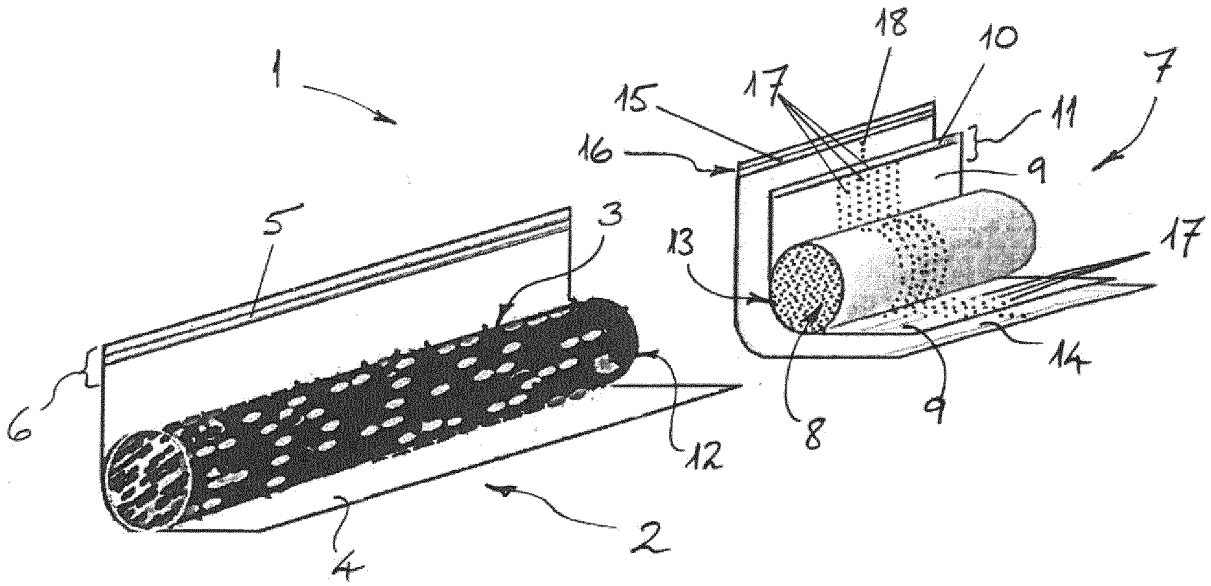

Fig. 1

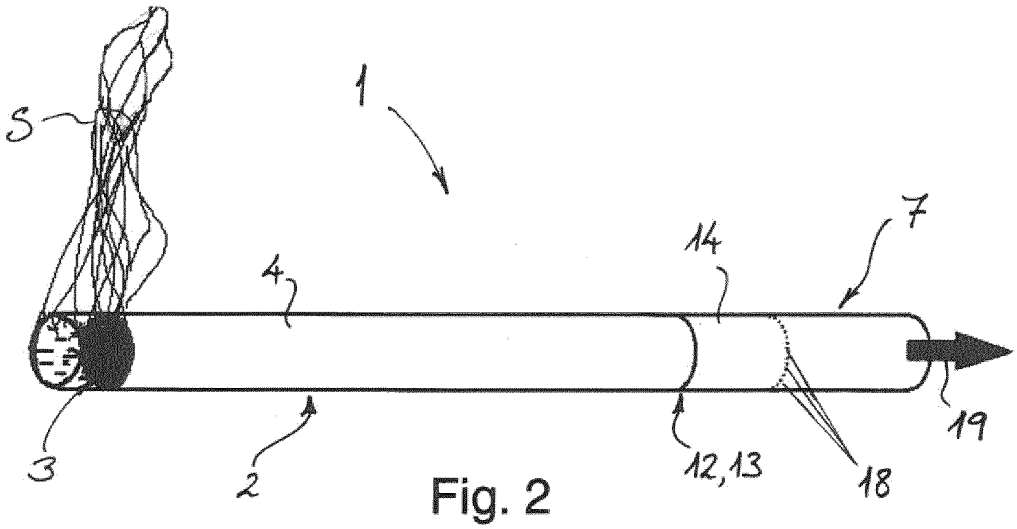

Fig. 2

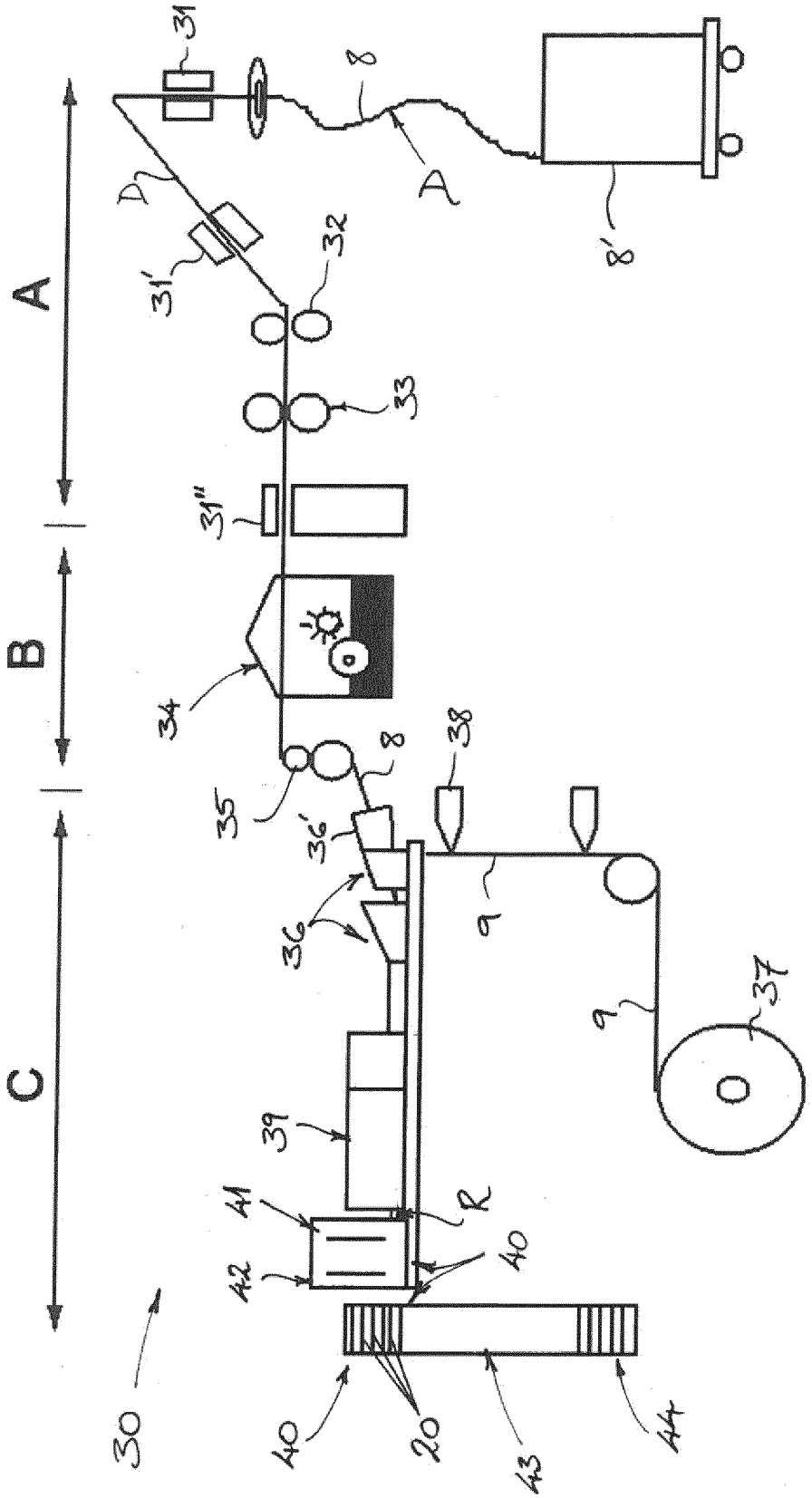

Fig. 3

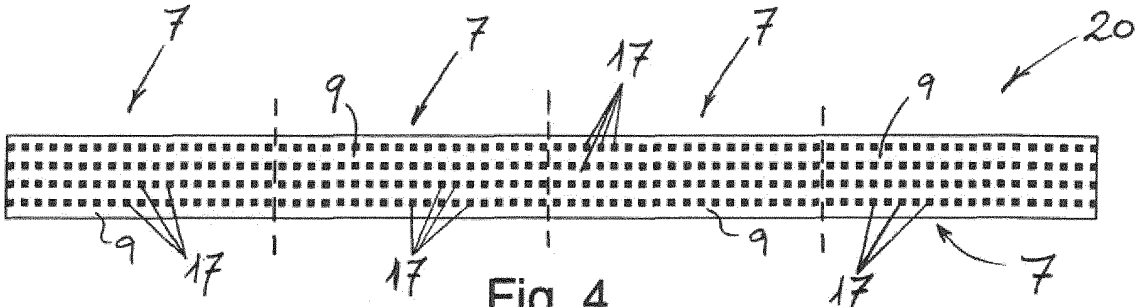

Fig. 4

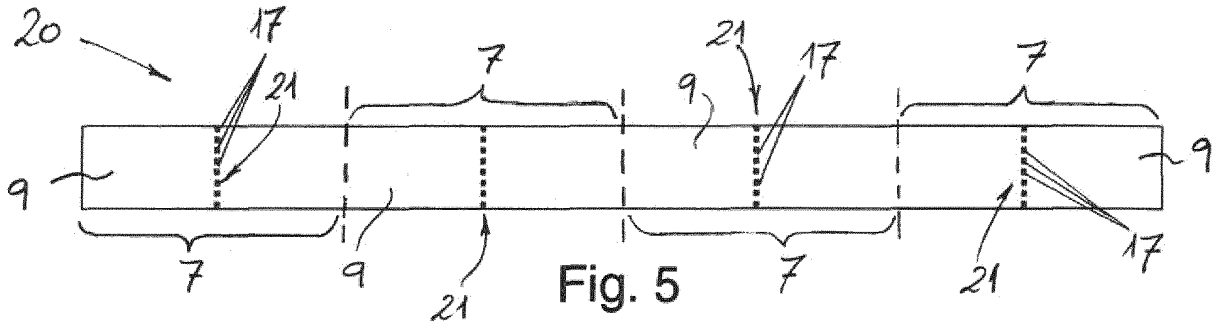

Fig. 5

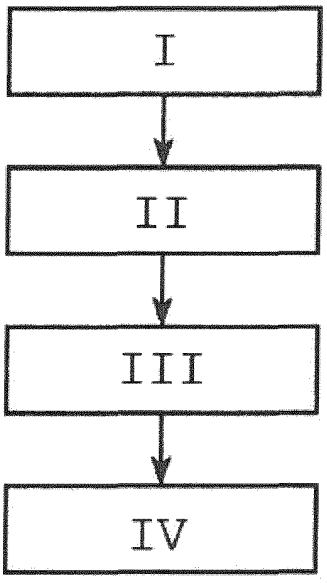

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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