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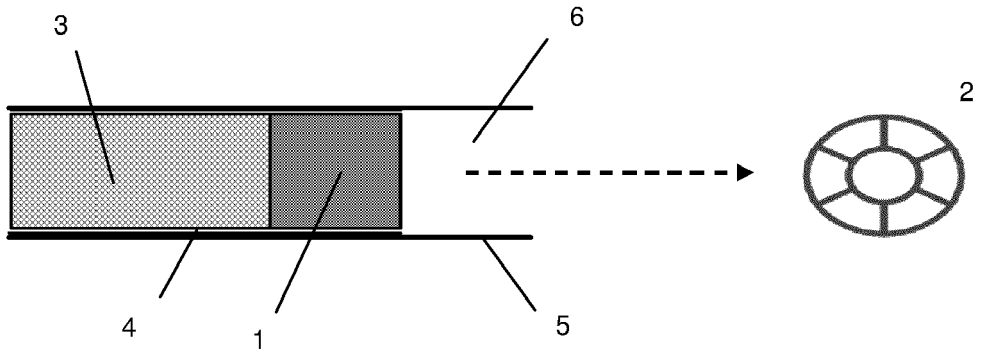
(54) **TOBACCO SMOKE FILTER**

(57) A tobacco smoke filter or filter element comprising a longitudinal extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core; wherein the longitudinal extending core includes a downstream element comprising a longitudinally extending downstream core of tobacco smoke filtering material; a first inner wrapper engaged around the downstream core; and optionally a second inner wrapper engaged around the first inner wrapper; the first inner wrapper having a profiled (e.g. corrugated) outer surface which defines with the second inner wrapper or the outer wrapper at least one longitudinally extending channel; and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged, to define a cavity at the downstream end of the filter.

Figure 1



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Description

[0001] The present invention relates to filters and filter elements for smoking articles such as cigarettes.

[0002] It is becoming increasingly desirable to provide a distinctive end appearance for cigarettes. Cigarette counterfeiting is a major problem and creating a distinctive and/or unusual appearance for a cigarette brand is an important way of deterring the counterfeiting of that brand. Further, the increasing restrictions on advertising and packaging of cigarettes mean that appearance of the cigarette is one of the few ways in which cigarette manufacturer can differentiate their product from those of other manufacturers. Provision of a cigarette filter with a distinctive end appearance can help achieve these goals.

[0003] Recess filters are well known in the tobacco industry and provide a means of creating unique end appearance for cigarettes. They are typically manufactured by wrapping a continuous stream of filter segments at spaced intervals in a relatively stiff plug wrap paper. By cutting the filter stream in a region where no filter element is present, a recess filter can be obtained - the stiff plug-wrap paper providing sufficient rigidity to enable the final cigarette to be manufactured and used without crushing the exposed paper end of the filter. Recess filters can incorporate one, two or more (e.g. fibrous) filter segments. When two or more segments are used, these will typically be of different filter configurations - e.g. of different filter materials or carrying different additives (such as flavours or adsorbents).

[0004] Extruded plastic tips for cigarette filters are also known, see for example US 3396733. These provide another way of creating a distinctive end appearance for cigarettes. These tips generally have a hollow inner body with a plurality of radial supporting ribs. Such tips may be used as the downstream or mouth-end segment of a multi-segment filter and are known generically as SPF (Shaped Plastic Filter).

[0005] A still further means of providing a distinctive type of cigarette filters are CPA™ filters from Filtrona, e.g. as exemplified in WO 2007/135414. These incorporate a filter body that is wrapped in a paper inner wrap (that has been embossed along part of its length) that is then encased in a conventional outer plugwrap. The embossed inner wrap creates a fluted appearance when the filter is cut in this region. When used at the mouth end of the filter, it creates a distinctive end appearance for the cigarette. It is possible to use this type of filter as a single unitary product or as a segment within a multi-segment filter.

[0006] There is a requirement to provide filters with even more distinctive end appearances that are difficult to counterfeit.

[0007] According to the present invention there is provided a tobacco smoke filter (or filter element) comprising: a longitudinally extending (e.g. cylindrical) core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core; wherein the longitudinally extending core includes one or more channels extending longitudinally upstream from the downstream end of the core; and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged to define a (e.g. tubular) cavity at the downstream end of the filter. The radially inner face of the outer wrapper which extends beyond the downstream end of the core around which it is engaged may define (e.g. with the downstream end of the longitudinally extending core) a cavity or recess, e.g. a tubular cavity/recess, at the downstream end of the recess filter.

[0008] The combination of a recess filter with a downstream end (mouth end) of the filter which includes (one or more) visible channels which extend longitudinally upstream from the downstream end of the core provides a very distinctive end appearance which is difficult to counterfeit.

[0009] In one example, the longitudinally extending core comprises a hollow tube of tobacco smoke filtering material. The tobacco smoke filtering material may be for example cellulose acetate filtering material. The cross section of the hollow tube (and therefore the channel) may be circular or non-circular. The wall or walls of the hollow tube of circular or non-circular cross section define a channel extending longitudinally upstream from the downstream end of the core. The channel generally does not extend the full length of the core. It may be expected that these types of filter would give rise to improved sensory characteristics and a cooler smoke as it is possible to control the mixing and channeling of smoke flow within the tubular segment and thence into the recess end, prior to entering the smoker's palate.

[0010] According to an aspect of the present invention there is provided a tobacco smoke filter (or filter element) comprising a longitudinal extending (e.g. cylindrical) core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinally extending core includes a downstream element (e.g. downstream segment) comprising a longitudinally extending tube having a plurality of spaced ribs extending generally inwardly (e.g. radially inwardly) to a longitudinally extending inner body which define (a plurality of) longitudinally extending channels therebetween (e.g. between the ribs);
and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which it is engaged (and extends beyond the downstream end of the downstream element), to define a (e.g. tubular) cavity at the downstream end of the filter.

[0011] The radially inner face of the outer wrapper which extends beyond the downstream end of the core around which is engaged defines (e.g. with the downstream end of the longitudinally extending core) a cavity or recess, e.g. a tubular cavity/recess, at the downstream end of the recess filter.

[0012] The downstream element (downstream segment) of the longitudinally extending core comprises a longitudinally extending tube having a plurality of spaced ribs extending generally inwardly (e.g. radially inwardly) to a longitudinally extending inner body which define (a plurality of) longitudinally extending channels therebetween (e.g. between the ribs). The inner body may be a hollow (e.g. tubular) inner body, the inner walls of the hollow inner body defining a further longitudinally extending channel. The downstream element [e.g. the longitudinally extending tube, spaced ribs and (e.g. hollow) inner body] may be integrally formed as a single element, for example by extrusion. The downstream element may be made of any thermoplastic material that can be extruded, e.g. LDPE. The downstream element may be made of degradable polymers. The downstream element may contain pigments to impart a desired colour or shade. The pigment may contrast with the colour of filtering material (e.g. may contrast with white or off white). The downstream element may be of any internal design, e.g. an internal channel with supporting ribs, e.g. as exemplified in UK Design Application No. 4017159.

[0013] The longitudinally extending core may include one or more (for example 1, 2, 3 or 4) further element(s) (segment or segments) comprising a tobacco smoke filtering material (located upstream of the upstream end of the downstream element). The tobacco smoke filtering material may be for example any of those materials (usually filamentary, fibrous, web or extruded) conventionally employed for tobacco smoke filter manufacture. The filtering material may be natural or synthetic filamentary tow, e.g. of cotton or plastics such as polyethylene or polypropylene, or cellulose acetate filamentary tow. It may be, for example, natural or synthetic staple fibres, cotton wool, web material such as paper (usually creped) and synthetic non-wovens, and extruded material (e.g. starch, synthetic foams).

[0014] Any type of filter construction known for use in cigarette filters may be used in these further elements (further segments), e.g. "Wrapped Acetate", "Non-Wrapped Acetate", "Random Orientated Acetate", "Cellulose Acetate" or "Active Acetate". Any number of elements (preferably of differing characteristics) may be used upstream of the downstream (e.g. "SPF") element, for example 1, 2, 3 or 4 segments. Where two or more further elements comprising a tobacco smoke filtering material are present, these further elements are preferably be of differing filtration characteristics, e.g. a cellulose acetate segment and an 'active acetate' segment.

[0015] One or more of the further elements may contain (e.g. particulate) additive material suitable for use in cigarette filter (e.g. activated carbon) and/or may contain a flavourant such as menthol.

[0016] The additive material may be a particulate additive. The particulate additive may any particulate additive suitable for use in a tobacco smoke filter - e.g. activated carbon, zeolite, ion exchange resin (e.g. a weakly basic anion exchange resin), sepiolite, silica gel, alumina, molecular sieves, carbonaceous polymer resins and diatomaceous earths. The particulate additive may be a mixture of two, or more, materials. The additive may include a flavourant - e.g. menthol - e.g. the additive may be sepiolite granules to which menthol has been applied. If the longitudinally extending extending core of tobacco smoke filtering includes fully enclosed (e.g. embedded) pocket(s) of additive embedded therein, the additive may be a particulate additive such as activated carbon (see above), which is for example enclosed within the filtering material as a discrete pocket or pod of particles of particulate additive which is substantially separate from, and fully enclosed within, the filtering material. In another example, the fully enclosed (e.g. embedded) pocket(s) of additive may be a frangible capsule or capsules, or one or a plurality of frangible microcapsules. The capsule(s) or microcapsule(s) may contain a variety of media - e.g. a flavourant and/or a liquid, solid or other material e.g. to aid smoke filtration. The use of capsules or microcapsules is well known in the art.

[0017] The (or a) further element may comprise a longitudinally extending cylindrical plug of cellulose acetate filtering material. The longitudinally extending cylindrical plug of cellulose acetate filtering material my further comprise a wrapper e.g. of porous or non porous plugwrap. Such wrapped filters/elements are known as "Wrapped Acetate" filters or filter elements.

[0018] The (or a) further element may comprise a longitudinally extending cylindrical plug of cellulose acetate filtering material further comprising a particulate additive, optionally with a wrapper e.g. of porous or non porous plugwrap. Such filters/elements are known as "Active Acetate" filters or filter elements.

[0019] The (or a) further element comprising a tobacco smoke filtering material may comprise a rod shaped core of tobacco smoke filtering material having fully enclosed (e.g. embedded) therewithin a (or at least one) pocket of additive (e.g. particulate additive). The rod shaped core of tobacco smoke filtering material may optionally have an additional wrapper (e.g. porous or non porous) engaged around the rod shaped core. The provision of the fully enclosed pocket of additive within the core of the tobacco smoke filtering material has the effect that the additive is distanced from the second end of the core (because there is tobacco smoke filtering material between the pocket of additive and the end of the core). The single longitudinally extending core of tobacco smoke filtering material comprising a rod shaped core of tobacco smoke filtering material having fully enclosed (e.g. embedded) therewithin a (or at least one) pocket of additive (e.g. particulate additive) may be manufactured, for example, by the methods and apparatus disclosed in WO 2006/059134.

[0020] The (or a) further element comprising a tobacco smoke filtering material may comprise a rod shaped core of tobacco smoke filtering material and an additive (e.g. particulate additive) bearing wrapper engaged around the rod shaped core, the additive bearing wrapper having

additive (e.g. particulate additive) adhered to one or more portion(s) of the radially inner face thereof with said additive bearing wrapper being free of additive around its circumference at the downstream end of the core. The absence of additive at the downstream end of the additive bearing wrapper has the effect that the additive is distanced from the downstream end of the core (because there no additive on the wrapper at the second end of the core). Preferably the additive bearing wrapper is free of additive around its circumference at both downstream and upstream ends of the core. The longitudinally extending core of tobacco smoke filtering material comprising a rod shaped core of tobacco smoke filtering material and an additive (e.g. particulate additive) bearing wrapper engaged around the rod shaped core, may be a filter element as disclosed in GB 2261152. The additive bearing wrapper may be porous or non porous.

[0021] The tobacco smoke filter may be of length 15 to 40 mm, e.g. 17 to 35 mm, e.g. 20 to 30 mm. The recess section of the filter (that is, the length by which the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged to define the cavity at the downstream (e.g. mouth) end of the filter) may have a length 3 to 10 mm, and is most preferably of length 4 to 6 mm. The longitudinally extending core (including the downstream element and any further elements which include tobacco smoke filtering material) may be of length 10 to 30 mm, e.g. 14 to 27 mm, e.g. 17 to 25 mm. The tobacco smoke filter may be of circumference 14 to 28 mm, for example 16 to 26 mm, for example 16 to 17 mm or 24 to 25 mm. The final filter cigarette may be ventilated or non-ventilated and of any circumference range traditionally used in smoking products (e.g. c. 14 to c. 28 mm circumference).

[0022] The outer wrapper may be paper, e.g. plugwrap paper, e.g. stiff plugwrap paper. The outer wrapper may be porous or non porous. The outer wrapper may be a paper of basis weight from about 40 to about 120 g/m^2. The outer wrapper may be of basis weight from about 80 to about 120 g/m^2, for example a basis weight of around 100 g/m^2, e.g. for a recess filter of standard (c. 24-25 mm) circumference. For slim or superslim recess filters (e.g. down to around 16-17 mm circumference), the outer wrapper may be a plugwrap paper of a lower basis weight, e.g. around 50 g/m^2. It will be appreciated that it is also possible to use stiffer tipping papers in conjunction with the plugwrap paper to give the desired stiffness to the final recess filter cigarette.

[0023] The use of a downstream element [e.g. the longitudinally extending tube, spaced ribs and (e.g. hollow) inner body] which is integrally formed as a single element, for example by extrusion (e.g. "SPF segment"), in a recess filter construction - rather than in its customary position at the mouth end of the filter - overcomes any unpleasantness of a 'plastic feel' to the cigarette should the smokers tongue come into direct contact with the extruded mouthpiece. It also provides a more preferable 'mouth feel' to the cigarette as the recess end is less hard that that associated with a rigid plastic mouthpiece. The combination of a recess and the downstream element (SPF section) at the mouth end of the filter also means that virtually no staining of the end of the filter is apparent to the smoker. It may be expected that these types of filter would give rise to improved sensory characteristics and a cooler smoke as it is possible to control the mixing and channeling of smoke flow within the SPF or tubular segment and thence into the recess end, prior to entering the smoker's palate.

[0024] According to another aspect of the present invention there is provided a tobacco smoke filter (or filter element) comprising a longitudinal extending (e.g. cylindrical) core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinal extending core includes a downstream element comprising a longitudinally extending (e.g. cylindrical) downstream core of tobacco smoke filtering material; a first inner wrapper engaged around the downstream core; and optionally a second inner wrapper engaged around the first wrapper; the first wrapper having a profiled (e.g. corrugated) outer surface which defines with the second inner wrapper or the outer wrapper at least one longitudinally extending channel [for example, at least one longitudinally extending channel extending longitudinally upstream from the downstream end of the downstream core];
and wherein the downstream end of the outer wrapper and/or the downstream end of the first inner wrapper extends beyond the downstream end of the core around which is engaged, to define a (e.g. tubular) cavity at the downstream end of the filter. The radially inner face of the outer wrapper or the radially inner face of the first inner wrapper which extends beyond the downstream end of the core around which it is engaged may define (e.g. with the downstream end of the longitudinally extending core/downstream core) a cavity or recess, e.g. a tubular cavity/recess, at the downstream end of the recess filter. The first inner wrapper may be of air permeable or air impermeable material. Preferably it is air permeable. The second inner wrapper (if present) may be of air permeable or air impermeable material.

[0025] The (or each) channel may extend longitudinally upstream from the downstream end of the downstream core. Preferably the or each channel extends only part of the length of the downstream core. The or each channel will preferably be of substantially uniform depth over its longitudinal extent, although there may be variation, for example where a channel approaches a closed end.

[0026] The (or each) channel may (alternatively or additionally) extend longitudinally downstream from the downstream end of the downstream core (into the recess area).

[0027] The first wrapper may, for example, be a sheet having a profiled (e.g. corrugated) surface, the sheet being wrapped with the profiled surface facing the outer wrapper or the second wrapper. The first wrapper pref-

erably has longitudinally (e.g. axially) extending corrugations which define at least with the second wrapper or the outer wrapper a longitudinally extending channel(s) - for example which extending longitudinally (upstream) from the downstream end of the downstream core. Each channel may be provided by the corrugation of the first wrapper being closed or blocked at the end remote from the downstream end of the downstream core from which the channel extends. The first wrapper is corrugated on both surfaces, and may define longitudinally extending channels with the downstream core as well as with the second wrapper or outer wrapper. The enwrapped downstream core surface may however conform to the corrugated inner surface of the first wrapper, leaving channels only between the first inner wrapper and the second inner wrapper or outer wrapper.

[0028] The (or each) portion of the downstream core which includes longitudinal channels (e.g. which includes corrugations) is referred to herein as a flute or fluted portion. The (or each) part or portion of the downstream core which does not include longitudinal channels (over the core cross section) is referred to herein as a bar or bar portion. It will be appreciated that in this aspect of the invention there will be a flute portion at the downstream (recess) end of the downstream core, to give - together with the recess - the distinctive end appearance. There may be a further flute portion at the upstream (non recess end) of the downstream core. In one example the downstream core includes a 3mm flute portion at each end and a single central bar portion as the remaining full length of the downstream core. Such a configuration may have the further advantage that the amount of filtering material in the downstream core (e.g. cellulose acetate tow) may be reduced because the pressure drop (PD/mm) of the bar is higher than that of the flute.

[0029] This aspect of the invention may provide a recess at the mouth (downstream) end, immediately upstream of which is a fluted or "CPA" element (segment) in which the longitudinal channel(s) or groove(s) face towards the mouth end to create a more distinctive end appearance. There may be one or more further elements (segments) of filtration material upstream of the CPA segment, as is discussed in more detail below. Any filter segments located further upstream of the CPA segment will preferably have differing filtration characteristics to the CPA segment, e.g. incorporating particulate additives and/or flavours.

[0030] The downstream core may include up to 23 channels, preferably between 14 and 20 channels, [e.g. extending longitudinally upstream from the downstream end of the core (for a filter of around 25mm circumference)]. The total cross-sectional area of these channels may amount to between 2 and 12%, preferably at least 4%, more preferably between 4 and 8%, of the overall cross-sectional area of the filter. Thus, careful control over the number and/or depth of the channels (e.g. by controlled embossing of the first wrapper) can give improved filtering performance. This may be achieved by increasing the depth of the corrugations, preferably with increase in surface area of the corrugations available to smoke, and optionally along with increase in the corrugation pitch - that is, widening of the corrugations with reduction in their number. For example, a filter according to the invention may have 15 channels at the downstream end of the downstream core which are about 0.45mm deep and at a pitch of about 1.5mm; another filter may have 0.32mm deep channels, the number of channels being 23, at a pitch of 1.05mm. The area of the corrugated wrap available for smoke filtration in these examples is generally a little less than the total corrugated surface area, since the crest of corrugations will generally be against the outer wrapper and hence not effective to filter.

[0031] The first wrapper may define with the second inner wrapper or the outer wrapper at least one channel extending longitudinally upstream from the downstream end of the downstream core and at least one channel extending longitudinally downstream from the upstream end of the downstream core, each channel extending only part of the downstream core length, wherein at least one portion of the downstream core includes no longitudinally extending channels.

[0032] Preferably, the length of each channel is 2mm or greater, preferably between 2.5mm and 23mm, more preferably between 3mm and 15mm, more preferably between 3.5mm and 9mm. The channel or channels extending from one end (upstream or downstream) may be a different length to those extending from the other end, or they may be the same length. The channels at both ends of the downstream core may be between 7 and 8mm long. The channels at both ends of the downstream core may be between 3 and 4mm long, for example 3.75mm long. Provision of channels of these dimensions means that the performance of the downstream core (tar retention etc) will be acceptable and should additionally ensure that the advantages of the present invention (e.g. consistent pressure drop, enhanced retention) are obtained.

[0033] The longitudinally extending core may comprise only the downstream core, or may include one or more (for example 1, 2, 3 or 4) further element(s) (segment or segments) comprising a tobacco smoke filtering material. The further elements will be located upstream of the downstream core. The tobacco smoke filtering material may be for example any of those materials (usually filamentary, fibrous, web or extruded) conventionally employed for tobacco smoke filter manufacture. The filtering material may be natural or synthetic filamentary tow, e.g. of cotton or plastics such as polyethylene or polypropylene, or cellulose acetate filamentary tow. It may be, for example, natural or synthetic staple fibres, cotton wool, web material such as paper (usually creped) and synthetic non-wovens, and extruded material (e.g. starch, synthetic foams).

[0034] Any type of filter construction known for use in cigarette filters may be used in these further elements (further segments), e.g. "Wrapped Acetate", "Non-

Wrapped Acetate", "Random Orientated Acetate", "Cellulose Acetate" or "Active Acetate". Any number of elements (preferably of differing characteristics) may be used upstream of the downstream (e.g. "CPA") element, for example 1, 2, 3 or 4 segments. Where two or more further elements comprising a tobacco smoke filtering material are present, these further elements are preferably be of differing filtration characteristics, e.g. a cellulose acetate segment and an 'active acetate' segment.

[0035] One or more of the further elements may contain (e.g. particulate) additive material suitable for use in cigarette filter (e.g. activated carbon) and/or may contain a flavourant such as menthol.

[0036] The additive material may be a particulate additive. The particulate additive may any particulate additive suitable for use in a tobacco smoke filter - e.g. activated carbon, zeolite, ion exchange resin (e.g. a weakly basic anion exchange resin), sepiolite, silica gel, alumina, molecular sieves, carbonaceous polymer resins and diatomaceous earths. The particulate additive may be a mixture of two, or more, materials. The additive may include a flavourant - e.g. menthol - e.g. the additive may be sepiolite granules to which menthol has been applied. If the longitudinally extending extending core of tobacco smoke filtering includes fully enclosed (e.g. embedded) pocket(s) of additive embedded therein, the additive may be a particulate additive such as activated carbon (see above), which is for example enclosed within the filtering material as a discrete pocket or pod of particles of particulate additive which is substantially separate from, and fully enclosed within, the filtering material. In another example, the fully enclosed (e.g. embedded) pocket(s) of additive may be a frangible capsule or capsules, or one or a plurality of frangible microcapsules. The capsule(s) or microcapsule(s) may contain a variety of media - e.g. a flavourant and/or a liquid, solid or other material e.g. to aid smoke filtration. The use of capsules or microcapsules is well known in the art.

[0037] The (or a) further element may comprise a longitudinally extending cylindrical plug of cellulose acetate filtering material. The longitudinally extending cylindrical plug of cellulose acetate filtering material my further comprise a wrapper e.g. of porous or non porous plugwrap. Such wrapped filters/elements are known as "Wrapped Acetate" filters or filter elements.

[0038] The (or a) further element may comprise a longitudinally extending cylindrical plug of cellulose acetate filtering material further comprising a particulate additive, optionally with a wrapper e.g. of porous or non porous plugwrap. Such filters/elements are known as "Active Acetate" filters or filter elements.

[0039] The (or a) further element comprising a tobacco smoke filtering material may comprise a rod shaped core of tobacco smoke filtering material having fully enclosed (e.g. embedded) therewithin a (or at least one) pocket of additive (e.g. particulate additive). The rod shaped core of tobacco smoke filtering material may optionally have an additional wrapper (e.g. porous or non porous) engaged around the rod shaped core. The provision of the fully enclosed pocket of additive within the core of the tobacco smoke filtering material has the effect that the additive is distanced from the second end of the core (because there is tobacco smoke filtering material between the pocket of additive and the end of the core). The single longitudinally extending core of tobacco smoke filtering material comprising a rod shaped core of tobacco smoke filtering material having fully enclosed (e.g. embedded) therewithin a (or at least one) pocket of additive (e.g. particulate additive) may be manufactured, for example, by the methods and apparatus disclosed in WO 2006/059134.

[0040] The (or a) further element comprising a tobacco smoke filtering material may comprise a rod shaped core of tobacco smoke filtering material and an additive (e.g. particulate additive) bearing wrapper engaged around the rod shaped core, the additive bearing wrapper having additive (e.g. particulate additive) adhered to one or more portion(s) of the radially inner face thereof with said additive bearing wrapper being free of additive around its circumference at the downstream end of the core. The absence of additive at the downstream end of the additive bearing wrapper has the effect that the additive is distanced from the downstream end of the core (because there no additive on the wrapper at the second end of the core). Preferably the additive bearing wrapper is free of additive around its circumference at both downstream and upstream ends of the core. The longitudinally extending core of tobacco smoke filtering material comprising a rod shaped core of tobacco smoke filtering material and an additive (e.g. particulate additive) bearing wrapper engaged around the rod shaped core, may be a filter element as disclosed in GB 2261152. The additive bearing wrapper may be porous or non porous.

[0041] The tobacco smoke filter may be of length 15 to 40 mm, e.g. 17 to 35 mm, e.g. 20 to 30 mm. The recess section of the filter (that is, the length by which the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged to define the cavity at the downstream (e.g. mouth) end of the filter) may have a length 3 to 10 mm, and is most preferably of length 4 to 6 mm. The longitudinally extending core (including the downstream fluted core and any further elements which include tobacco smoke filtering material) may be of length 10 to 30 mm, e.g. 14 to 27 mm, e.g. 17 to 25 mm. The tobacco smoke filter may be of circumference 14 to 28 mm, for example 16 to 26 mm, for example 16 to 17 mm or 24 to 25 mm. The final filter cigarette may be ventilated or non-ventilated and of any circumference range traditionally used in smoking products (e.g. c. 14 to c. 28 mm circumference).

[0042] The outer wrapper may be paper, e.g. plugwrap paper, e.g. stiff plugwrap paper. The outer wrapper may be porous or non porous. The outer wrapper may be a paper of basis weight from about 40 to about 120 g/m^2. The outer wrapper may be of basis weight from about 80 to about 120 g/m^2, for example a basis weight of around

100 g/m^2, e.g. for a recess filter of standard (c. 24-25 mm) circumference. For slim or superslim recess filters (e.g. down to around 16-17 mm circumference), the outer wrapper may be a plugwrap paper of a lower basis weight, e.g. around 50 g/m^2. It will be appreciated that it is also possible to use stiffer tipping papers in conjunction with the plugwrap paper to give the desired stiffness to the final recess filter cigarette.

[0043] In examples of this aspect of the invention, the first inner wrapper may extend beyond the downstream end of the downstream core/downstream element around which is engaged to define (e.g. either alone or together with the outer wrapper) the (e.g. tubular) cavity at the downstream end of the filter. In such instances, the second inner wrapper of the downstream core may be omitted because a further wrapper (e.g. the outer wrapper used to wrap the final recess filter) may be required to combine the various segments of the filter. However, it will be appreciated that an (e.g. embossed) first inner wrapper of basis weight, e.g. 80 g/m^2, may enable an outer wrapper of lower weight, e.g. 40 g/m^2, to be used yet still provide sufficient rigidity at the recess end.

[0044] The first inner wrapper and/or second inner wrapper may be coloured or pigmented to enhance the distinctiveness of the end appearance. Preferably the colour or pigment contrasts with the e.g. white filtering material.

[0045] The first inner wrapper does not necessarily extend beyond the downstream end of the downstream core. In such examples, the downstream core and first inner wrapper may be wrapped in a second inner wrapper (as is conventional for a known "CPA" filter element of this type) prior to being overwrapped in the (heavyweight plugwrap) outer wrapper which defines the cavity when the finished recess filter is assembled. In other examples, the second inner wrapper may be omitted. It will be appreciated that these examples will create a different end appearance to examples in which the first inner wrapper extends downstream to within (or to define) the recess section of the final filter.

[0046] In a filter cigarette according to the invention, a filter of the invention (or a filter which includes a filter element of the invention) is joined to a wrapped tobacco rod with one end of the filter towards the tobacco. The filter may, for example, be joined to the wrapped tobacco rod by ring tipping [which engages around just the adjacent ends of the (wrapped) filter and rod to leave much of the filter wrap exposed] or, more preferably, by a full tipping overwrap (which engages around the full filter length and the adjacent end of the tobacco rod). The cigarette may include a tipping overwrap (of e.g. a stiff tipping paper) in conjunction with the outer wrapper of the filter to give the desired (e.g. further increased) stiffness to the final recess filter cigarette.

[0047] Any filter or filter cigarette according to the invention may be unventilated, or may be ventilated by methods well known in the art, e.g. by use of a pre-perforated or air-permeable wrapper (plugwrap), and/or laser perforation of wrapper (plugwrap) and tipping overwrap. A ventilating full tipping overwrap may likewise be inherently air-permeable or provided with ventilation holes, and in ventilated products where both filter plugwrap and tipping overwrap are present ventilation through the overwrap will usually be in register with that through the plugwrap. Ventilation holes through a filter plugwrap, or through a tipping overwrap, or through both simultaneously, may be made by laser perforation during filter or filter cigarette production.

[0048] Where ventilation in a filter or filter cigarette according to the invention is localised longitudinally of a product which includes an additive e.g. activated carbon, this localisation is preferably to one or two regions selected from upstream of, downstream of, and in register with the additive. Thus, ventilation in a filter or filter cigarette according to the invention may be localised longitudinally of the filter or filter cigarette, for example to one or two regions selected from upstream of, downstream of, and in register with a pocket (or patch or portion) of additive, depending upon the ventilation and filtering performances required. Preferably, ventilation in a filter or filter cigarette according to the invention may be localised longitudinally of the filter or filter cigarette, for example in register with a further element which is an "Active Acetate" filter or filter element, as described above. Ventilation upstream of and/or in register with e.g. a pocket of first additive (if present) is frequently preferred. There may be ventilation between portions (or pockets or patches) of second additive when two or more are present.

[0049] According to the invention in a further aspect there is provided a multiple rod comprising a plurality (e.g. 2, 4, 6 etc.) of filters (or filter elements) as described above and/or herein integrally joined end-to-end in a mirror image relationship. Multiple rods and their methods of manufacture are known in the art.

[0050] The present invention will now be illustrated with reference to the following Examples and the attached drawings in which **FIGURE 1** schematically illustrates a recess filter according to a first example of the invention; **FIGURE 2** schematically illustrates a recess filter according to a second example of the invention; **FIGURE 3** schematically illustrates a recess filter according to a further example of the invention; and **FIGURE 4** schematically illustrates a recess filter according to a different further example of the invention.

Examples

[0051] Figure 1 shows a "Recess SPF" filter tip which is an example of the invention. The filter comprises a longitudinally extending cylindrical core including a downstream element (1) and a further element (3) comprising a tobacco smoke filtering material. The downstream element (1) comprises an extruded HDPE section of length 5mm in the form of a longitudinally extending cylindrical tube having six spaced ribs extending radially inwardly to a longitudinally extending inner body in the

form of a further hollow cylindrical tube. The ribs (together with the radially inner face of the cylindrical tube and the radially outer face of the inner body) define six longitudinally extending channels. The hollow tubular inner body defines a further longitudinally extending channel within the inner body. The cross sectional profile of HDPE section (1) is shown in (2). The further element (3) comprises a cylindrical plug of tobacco smoke filtering material in the form of cellulose acetate fibres and is of length 18mm. Further element (3) is abutted up to the upstream end of extruded downstream element (1) and elements (3) and (1) are joined using a plugwrap (4) of basis weight 27 g/m^2 which is applied by means well known in the art. An outer wrapper (5) of 100 g/m^2 plugwrap is engaged around the longitudinally extending core (i.e. elements (3) and (1)) so as to completely overwrap the core; the downstream end of the outer wrapper (5) extends beyond the downstream end of the longitudinally extending core [and the downstream element (1) around which it is engaged] to define a tubular cavity or recess (6) of length 4mm at the downstream end of the filter. The outer wrapper is applied by means well-known in the art. This results in a recess filter of overall length 27mm.

[0052] It will be appreciated that the combination of the recess (6) and the downstream element (1) with a downstream end (mouth end) of cross section (2) which includes channels which extend longitudinally upstream from the downstream end of the core/downstream element provides a very distinctive end appearance which is difficult to counterfeit.

[0053] Figure 2 shows a further example of a "Recess SPF" tip which is an example of the invention. The filter comprises a longitudinally extending cylindrical core including a downstream element (1a); a first further element (3a) comprising a tobacco smoke filtering material; and a second further element (7a) comprising a tobacco smoke filtering material. The downstream element (1a) comprises an extruded HDPE section of length 5mm in the form of a longitudinally extending cylindrical tube having six spaced ribs extending radially inwardly to a longitudinally extending inner body in the form of a further hollow cylindrical tube. The ribs (together with the radially inner face of the cylindrical tube and the radially outer face of the inner body) define six longitudinally extending channels. The hollow tubular inner body defines a further longitudinally extending channel within the inner body. Thus, the cross sectional profile of HDPE section (1a) is similar to that shown in Figure 1, (2). The first further element (3a) comprises a cylindrical plug of tobacco smoke filtering material in the form of cellulose acetate fibres of length 8mm, and is positioned immediately upstream of extruded section (1a). The second further element (7a) comprises an "active acetate " segment in the form of a cylindrical plug of tobacco smoke filtering material in the form of cellulose acetate fibres which includes particulate additive in the form of activated carbon. The second further element (7a) is of length 10mm and is positioned at the upstream end of the filter (this end would be connected to the tobacco column in the finished filter cigarette). Filter segments (1a), (3a) and (7a) are connected together using a plugwrap (4) of basis weight 27 g/m^2 by means well known in the art. An outer wrapper (5) of 100 g/m^2 plugwrap is engaged around the longitudinally extending core (i.e. elements (7a), (3a) and (1a)) so as to completely overwrap the core; the downstream end of the outer wrapper (5) extends beyond the downstream end of the longitudinally extending core [and the downstream element (1a) around which it is engaged] to define a tubular cavity or recess (6) of length 4mm at the downstream end of the filter. The outer wrapper is applied by means well-known in the art. This results in a recess filter of overall length 27mm.

[0054] Again, it will be appreciated that the combination of the recess (6) and the downstream element (1a) with a downstream end (mouth end) of cross section (2) which includes channels which extend longitudinally upstream from the downstream end of the core provides a very distinctive end appearance which is difficult to counterfeit.

[0055] Figure 3 shows a "Recess CPA" filter tip which is an example of the invention. The filter includes a longitudinal extending (e.g. cylindrical) core comprising a downstream core (8) and a further element (11) located upstream of the downstream core. The further element (11) comprises an 15mm long "active acetate" segment in the form of a cylindrical plug of tobacco smoke filtering material in the form of cellulose acetate fibres which includes particulate additive in the form of activated carbon. The downstream core (8) comprises a longitudinal cylindrical plug of 8mm length comprising cellulose acetate fibres wrapped in a first inner wrapper (9) comprising a plugwrap of basis weight 80 g/m^2. The plugwrap which forms inner wrapper (9) is embossed for a part of its length with 15 grooves of about 0.45mm depth and pitch about 1.5mm. The plug is wrapped by the inner wrapper (9) such that it is surrounded by a region of unembossed plugwrap for about 4mm of its length ('bar region') at its upstream end, and surrounded by a region of embossed plugwrap ('flute region') for the remaining 4mm length at its downstream end; the embossed region ('flute region') of the inner wrapper of plugwrap extends downstream beyond the downstream end of the plug by a further 4mm. The downstream core (8) and the further element (11) are joined together by an outer wrapper (12) in the form of a stiff plugwrap of weight 50 g/m^2, the downstream end of outer wrapper (12) also extends 4mm beyond the downstream end of the core (8) around which is engaged, to define [together with the inner wrapper (9)] a tubular cavity of length 4mm at the downstream end of the filter. The embossed region of the inner wrapper (9) defines, with the outer wrapper (12) which is engaged around the inner wrapper, fifteen grooves or channels which extend longitudinally upstream from the downstream end of the downstream core into the downstream core, and which extend longitudinally downstream from the downstream end of the downstream core into the cavity/recess region.

It will be appreciated that the combination of the stiff outer wrapper (12) of plugwrap and the embossed inner wrapper (9) of plugwrap creates a rigid recess (10) of length 4mm with a distinctive fluted end appearance defined by the embossed pattern of the inner wrapper (9) and the outer wrapper (12).

[0056] Figure 4 shows a Recess CPA filter tip which is further example of the invention. The filter includes a longitudinal extending (e.g. cylindrical) core comprising a downstream core (8a) and a further element (11) located upstream of the downstream core. The further element (11) comprises an 12mm long "active acetate" segment in the form of a cylindrical plug of tobacco smoke filtering material in the form of cellulose acetate fibres which includes particulate additive in the form of activated carbon. The downstream core (8a) comprises a longitudinal cylindrical plug of 11mm length comprising cellulose acetate fibres wrapped in a first inner wrapper (9a) comprising a plugwrap of basis weight 80 g/m^2. The plugwrap which forms inner wrapper (9a) is embossed for part of its length with 15 grooves of about 0.45mm depth and pitch about 1.5mm. The plug is wrapped by the inner wrapper (9a) such that it is surrounded by a region of unembossed plugwrap for about 5mm of its length ('bar region') at its upstream end, and surrounded by a region of embossed plugwrap ('flute region') for the remaining 6mm length at its downstream end. The downstream core (8a) and the further element (11) are joined together by an outer wrapper (12a) in the form of a stiff plugwrap of weight 100 g/m^2; the downstream end of outer wrapper (12) extends 4mm beyond the downstream end of the downstream core (8a) around which is engaged, to define a tubular cavity of length 4mm at the downstream end of the filter. The inner wrapper (9a) defines with the outer wrapper (12a) fifteen grooves or channels which extend longitudinally upstream from the downstream end of the downstream core, and are visible within the recess/cavity formed by outer wrapper (12a).

[0057] It will be appreciated that the combination of the recess and the fluted end appearance of the downstream core (8a) defined by the embossed pattern of the inner wrapper (9) and the outer wrapper 12 provides a distinctive end appearance visible from the end of the filter cigarette.

[0058] It will be appreciated that the filters described above, which include multi-segment recess filters, may be made by conventional means. It will be appreciated that the filters described above may be used to make filter cigarettes by conventional means. For example, a filter of the invention may be joined to a wrapped tobacco rod with one end of the filter towards the tobacco. The filter may, for example, be joined to the wrapped tobacco rod by ring tipping [which engages around just the adjacent ends of the (wrapped) filter and rod to leave much of the filter wrap exposed] or, more preferably, by a full tipping overwrap (which engages around the full filter length and the adjacent end of the tobacco rod). The cigarette may include a tipping overwrap (of e.g. a stiff tipping paper) in conjunction with the outer wrapper of the filter to give the desired (e.g. further increased) stiffness to the final recess filter cigarette.

[0059] There are disclosed herein tobacco smoke filters, filter elements, filter cigarettes and multiple rods according to the following numbered paragraphs.

1. A tobacco smoke filter or filter element comprising:

   a longitudinally extending core which includes tobacco smoke filtering material;
   an outer wrapper engaged around the longitudinal extending core; wherein the longitudinally extending core includes one or more channels extending longitudinally upstream from the downstream end of the core wherein:

      (a) the longitudinally extending core includes a hollow tube of tobacco smoke filtering material; or
      (b) the longitudinally extending core includes a downstream element comprising a longitudinally extending tube having a plurality of spaced ribs extending generally inwardly to a longitudinally extending inner body, the ribs defining a plurality of longitudinally extending channels therebetween; or
      (c) wherein the longitudinal extending core includes a downstream element comprising a longitudinally extending downstream core of tobacco smoke filtering material; a first inner wrapper engaged around the downstream core; and optionally a second inner wrapper engaged around the first inner wrapper; the first inner wrapper having a profiled (e.g. corrugated) outer surface which defines with the second inner wrapper or the outer wrapper at least one longitudinally extending channel;

   and wherein the downstream end of the outer wrapper and/or the downstream end of the first inner wrapper extends beyond the downstream end of the core around which is engaged to define a cavity at the downstream end of the filter.

2. A tobacco smoke filter or filter element according to paragraph 1 wherein the longitudinally extending core includes a hollow tube of tobacco smoke filtering material which does not extend the full length of the core.

3. A tobacco smoke filter or filter element comprising a longitudinal extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinally extending core includes a

downstream element comprising a longitudinally extending tube having a plurality of spaced ribs extending generally inwardly to a longitudinally extending inner body, the ribs defining a plurality of longitudinally extending channels therebetween;
and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which it is engaged, to define a cavity at the downstream end of the filter.

4. A tobacco smoke filter or filter element according to paragraph 3 wherein the inner body is a hollow inner body having an inner wall(s) which defines a further longitudinally extending channel.

5. A tobacco smoke filter or filter element according to paragraph 3 or 4 wherein the downstream element is integrally formed as a single element.

6. A tobacco smoke filter or filter element according to paragraph 3, 4 or 5 wherein the downstream element is formed by extrusion.

7. A tobacco smoke filter or filter element comprising a longitudinal extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinal extending core includes a downstream element comprising a longitudinally extending downstream core of tobacco smoke filtering material; a first inner wrapper engaged around the downstream core; and optionally a second inner wrapper engaged around the first inner wrapper; the first inner wrapper having a profiled (e.g. corrugated) outer surface which defines with the second inner wrapper or the outer wrapper at least one longitudinally extending channel;
and wherein the downstream end of the outer wrapper and/or the downstream end of the first inner wrapper extends beyond the downstream end of the core around which is engaged, to define a cavity at the downstream end of the filter.

8. A tobacco smoke filter or filter element according to paragraph 7 wherein the first inner wrapper is engaged around the core with the profiled (e.g. corrugated) surface facing the outer wrapper or the second wrapper to define with the second wrapper or the outer wrapper the longitudinally extending channel(s).

9. A tobacco smoke filter or filter element according to paragraph 7 or 8 wherein at least one longitudinally extending channel extends longitudinally upstream from the downstream end of the downstream core.

10. A tobacco smoke filter or filter element according to paragraph 9 wherein the or each channel extends only part of the length of the downstream core.

11. A tobacco smoke filter or filter element according to any preceding paragraph wherein the longitudinally extending core includes one or more further element(s) comprising a tobacco smoke filtering material upstream of the downstream element.

12. A tobacco smoke filter or filter element according to paragraph 10 or 11 wherein the or a further element comprises a longitudinally extending cylindrical plug of cellulose acetate filtering material optionally further comprising a wrapper of porous or non porous plugwrap.

13. A tobacco smoke filter or filter element according to paragraph 10, 11 or 12 wherein the or a further element comprises a longitudinally extending cylindrical plug of cellulose acetate filtering material further comprising a particulate additive, optionally further comprising a wrapper of porous or non porous plugwrap.

14. A tobacco smoke filter or filter element comprising: a longitudinally extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinally extending core includes one or more channels extending longitudinally upstream from the downstream end of the core; and
wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged to define a cavity at the downstream end of the filter.

15. A tobacco smoke filter or filter element according to paragraph 14 wherein the longitudinally extending core includes a hollow tube of tobacco smoke filtering material.

16. A filter or filter element according to any preceding paragraph wherein the outer wrapper is paper, e.g. plugwrap paper.

17. A filter or filter element according to any preceding paragraph wherein the outer wrapper is paper having a basis weight from about 40 to about 120 g/m^2.

18. A tobacco smoke filter substantially as hereinbefore described with reference to any of the attached drawings.

19. A filter cigarette comprising a filter or filter element according to any preceding paragraph joined to a wrapped tobacco rod with the first end of the core towards the tobacco.

20. A multiple rod comprising a plurality (e.g. 2, 4, 6 etc.) of filters (or filter elements) according to any of paragraphs 1 to 18 integrally joined end-to-end in a mirror image relationship.

Claims

1. A tobacco smoke filter or filter element comprising a longitudinal extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core;
wherein the longitudinal extending core includes a downstream element comprising a longitudinally extending downstream core of tobacco smoke filtering material; a first inner wrapper engaged around the downstream core; and optionally a second inner wrapper engaged around the first inner wrapper; the first inner wrapper having a profiled (e.g. corrugated) outer surface which defines with the second inner wrapper or the outer wrapper at least one longitudinally extending channel;
and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged, to define a cavity at the downstream end of the filter.

2. A tobacco smoke filter or filter element according to claim 1 wherein the longitudinally extending core includes a hollow tube of tobacco smoke filtering material which does not extend the full length of the core.

3. A tobacco smoke filter or filter element according to claim 1 wherein the first inner wrapper is engaged around the core with the profiled (e.g. corrugated) surface facing the outer wrapper or the second wrapper to define with the second wrapper or the outer wrapper the longitudinally extending channel(s).

4. A tobacco smoke filter or filter element according to claim 1 or 3 wherein at least one longitudinally extending channel extends longitudinally upstream from the downstream end of the downstream core.

5. A tobacco smoke filter or filter element according to claim 4 wherein the or each channel extends only part of the length of the downstream core.

6. A tobacco smoke filter or filter element according to any preceding claim wherein the longitudinally extending core includes one or more further element(s) comprising a tobacco smoke filtering material upstream of the downstream element.

7. A tobacco smoke filter or filter element according to claim 6 wherein the or a further element comprises a longitudinally extending cylindrical plug of cellulose acetate filtering material optionally further comprising a wrapper of porous or non porous plugwrap.

8. A tobacco smoke filter or filter element according to claim 5, 6 or 7 wherein the or a further element comprises a longitudinally extending cylindrical plug of cellulose acetate filtering material further comprising a particulate additive, optionally further comprising a wrapper of porous or non porous plugwrap.

9. A tobacco smoke filter or filter element comprising: a longitudinally extending core which includes tobacco smoke filtering material; and an outer wrapper engaged around the longitudinal extending core; wherein the longitudinally extending core includes one or more channels extending longitudinally upstream from the downstream end of the core; and wherein the downstream end of the outer wrapper extends beyond the downstream end of the core around which is engaged to define a cavity at the downstream end of the filter.

10. A tobacco smoke filter or filter element according to claim 9 wherein the longitudinally extending core includes a hollow tube of tobacco smoke filtering material.

11. A filter or filter element according to any preceding claim wherein the outer wrapper is paper, e.g. plugwrap paper.

12. A filter or filter element according to any preceding claim wherein the outer wrapper is paper having a basis weight from about 40 to about 120 g/m^2.

13. A tobacco smoke filter or filter element according to any preceding claim wherein the first inner wrapper does not extend beyond the downstream end of the downstream core.

14. A filter cigarette comprising a filter or filter element according to any preceding claim joined to a wrapped tobacco rod with the first end of the core towards the tobacco.

15. A multiple rod comprising a plurality (e.g. 2, 4, 6 etc.) of filters (or filter elements) according to any of claims 1 to 14 integrally joined end-to-end in a mirror image relationship.

Figure 1

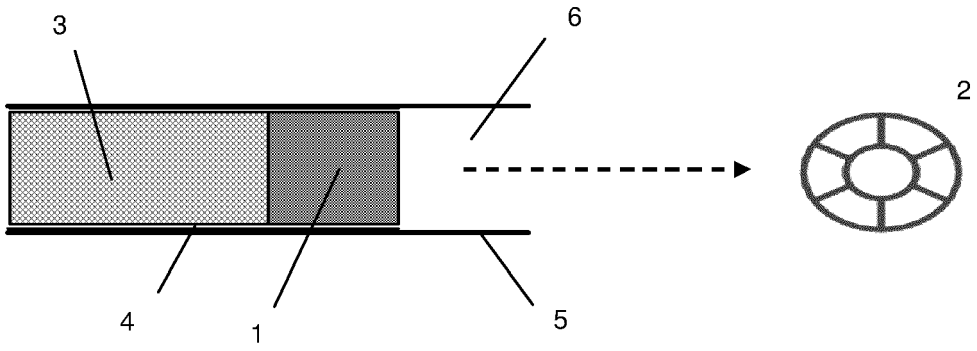


Figure 2

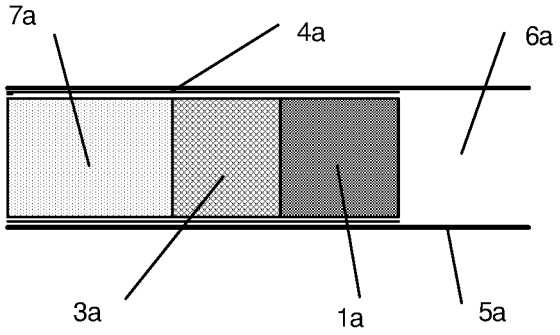


Figure 3

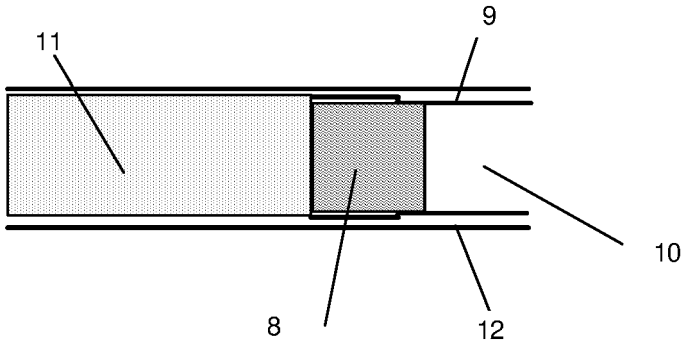
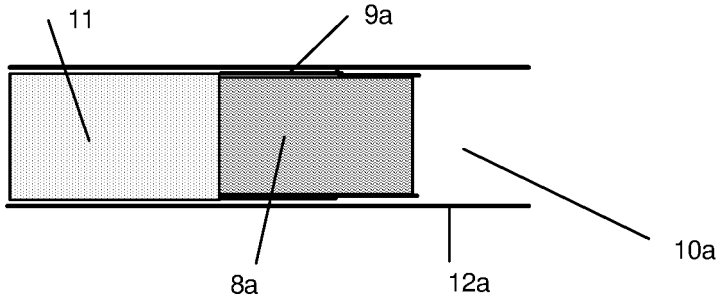


Figure 4



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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
The Hague	30 September 2021	Cobusneanu, D

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