

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau



WIPO | PCT



(10) International Publication Number

WO 2014/023555 A1

(43) International Publication Date

13 February 2014 (13.02.2014)

(51) International Patent Classification:

*A24C 5/47* (2006.01) *A24D 1/02* (2006.01)  
*A24D 3/02* (2006.01) *A24D 3/06* (2006.01)  
*A24D 3/04* (2006.01)

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(21) International Application Number:

PCT/EP2013/065330

(22) International Filing Date:

19 July 2013 (19.07.2013)

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

12179441.6 6 August 2012 (06.08.2012) EP

(71) Applicant: PHILIP MORRIS PRODUCTS S.A. [CH/CH]; Quai Jeanrenaud 3, CH-2000 Neuchâtel (CH).

(72) Inventor: KADIRIC, Alen; Schwadernauweg 33, CH-2504 Biel (CH).

(74) Agent: DOWLING, Ian; Reddie & Grose LLP, 16 Theobalds Road, London Greater London WC1X 8PL (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: METHOD OF FORMING SMOKING ARTICLES WITH MOUTH END CAVITIES

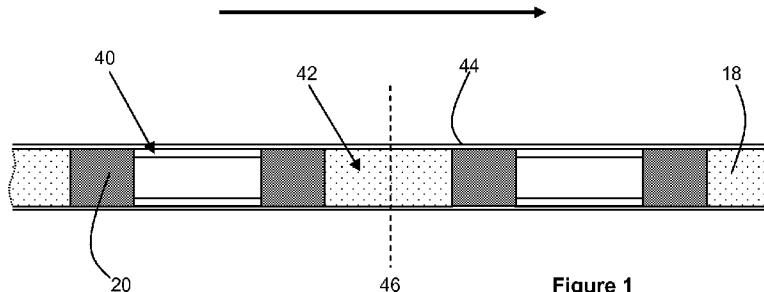


Figure 1

(57) Abstract: A method of producing smoking articles, the method comprising a first step of providing a continuous array of first filter members (42), second filter segments (20) and tubular members (40). A tubular member (40) is provided between each pair of consecutive first filter members (42) and a second filter segment (20) is provided between each first filter member (42) and each tubular member (40). Each second filter segment (20) contains one or more breakable capsules, wherein each breakable capsule comprises an outer shell and an inner core containing an additive. The continuous array of first filter members (42), second filter segments (20) and tubular members (40) is then wrapped with a continuous sheet of plug wrap (44) to form a wrapped filter array, wherein the plug wrap (44) has a basis weight of less than 90 grams per square metre. The wrapped filter array is cut at an intermediate position along each first filter member (42) to provide multiple filter rods, each filter rod comprising two first filter segments (18), a tubular member (40) positioned between the first filter segments (18) and a second filter segment (20) provided between each first filter segment (18) and the tubular member (40). Next, a tobacco rod (12) is provided in axial alignment with and adjacent to each first filter segment (18) of one of the filter rods, and the filter rod and a portion of each tobacco rod (12) are wrapped in a tipping wrapper (50). Finally, the tipping wrapper (50) and the filter rod are cut at an intermediate position along the length of the tubular member (40) to form multiple smoking articles (10), each smoking article (10) comprising a tobacco rod (12) connected to a filter (14), wherein each filter (14) comprises a first filter segment (18) downstream of the tobacco rod (12), a second filter segment (20) downstream of the first filter segment (18), and a hollow tube segment (22) positioned between the second filter segment (20) and the mouth end of the filter (14). The hollow tube segment (22) defines a cavity (24) at the mouth end of the filter (14).

WO 2014/023555 A1

## METHOD OF FORMING SMOKING ARTICLES WITH MOUTH END CAVITIES

The present invention relates to a method of forming smoking articles each having a mouth end cavity formed by a hollow tube segment.

5 Filter cigarettes typically comprise a cylindrical rod of tobacco cut filler surrounded by a paper wrapper and a cylindrical filter axially aligned in an abutting end-to-end relationship with the wrapped tobacco rod. The cylindrical filter typically comprises a filtration material circumscribed by a paper plug wrap. Conventionally, the wrapped tobacco rod and the filter are joined by a band of tipping wrapper, normally formed of an opaque paper material that 10 circumscribes the entire length of the filter and an adjacent portion of the wrapped tobacco rod.

A number of smoking articles in which tobacco is heated rather than combusted have also been proposed in the art. In heated smoking articles, an aerosol is generated by heating a flavour generating substrate, such as tobacco. Known heated smoking articles include, for 15 example, electrically heated smoking articles and smoking articles in which an aerosol is generated by the transfer of heat from a combustible fuel element or heat source to a physically separate aerosol forming material. During smoking, volatile compounds are released from the aerosol forming substrate by heat transfer from the fuel element and entrained in air drawn through the smoking article. As the released compounds cool they condense to form an aerosol that is inhaled by the consumer. Smoking articles in which a nicotine-containing aerosol is 20 generated from a tobacco material, tobacco extract or other nicotine source, without combustion or heating, are also known.

Sometimes it is desirable to provide the filter section of a smoking article with a cavity at the mouth end. However, such mouth end cavities are prone to collapse or deformation during manufacture of the smoking article and during subsequent handling by the consumer, 25 particularly when the filtration material includes one or more flavour containing materials which must be activated by squeezing the filter prior to smoking.

It would therefore be desirable to provide a process for forming smoking articles having mouth end cavities, wherein the cavities are resistant to deformation and collapse during manufacture and subsequent handling of the smoking article.

30 Accordingly, the present invention provides a method of producing smoking articles, the method comprising a first step of providing a continuous array of first filter members, second filter segments and tubular members. A tubular member is provided between each pair of consecutive first filter members and a second filter segment is provided between each first filter member and each tubular member. Each second filter segment contains one or more 35 breakable capsules, wherein each breakable capsule comprises an outer shell and an inner core containing an additive. The continuous array of first filter members, second filter segments

and tubular members is then wrapped with a continuous sheet of plug wrap to form a wrapped filter array, wherein the plug wrap has a basis weight of less than 90 grams per square metre. The wrapped filter array is cut at an intermediate position along each first filter member to provide multiple filter rods, each filter rod comprising two first filter segments, a tubular member 5 positioned between the first filter segments and a second filter segment provided between each first filter segment and the tubular member. Next, a tobacco rod is provided in axial alignment with and adjacent to each first filter segment of one of the filter rods, and the filter rod and a portion of each tobacco rod are wrapped in a tipping wrapper. Finally, the tipping wrapper and the filter rod are cut at an intermediate position along the length of the tubular member to form 10 multiple smoking articles, each smoking article comprising a tobacco rod connected to a filter, wherein each filter comprises a first filter segment downstream of the tobacco rod, a second filter segment downstream of the first filter segment, and a hollow tube segment positioned between the second filter segment and the mouth end of the filter. The hollow tube segment defines a cavity at the mouth end of the filter.

15 Preferably, the hollow tube segment extends from the downstream end of the adjacent filter segment to the mouth end edge of the filter.

As used herein, the terms “upstream” and “downstream” are used to describe the relative positions of elements, or portions of elements, of a smoking article in relation to the direction in which a user draws on the smoking article during use thereof. Smoking articles as 20 described herein comprise a downstream end and an opposed upstream end. In use, a user draws on the downstream end of the smoking article. The downstream end, which is also described as the mouth end, is downstream of the upstream end, which may also be described as the distal end.

By utilising tubular members in the filter rods, the method according to the present 25 invention advantageously produces smoking articles each having a mouth end cavity which is resistant to collapse or deformation during manufacture. In particular, the tubular members provide sufficient mechanical rigidity to resist deformation during cutting of the wrapped filter array to form each filter rod and during cutting of the tubular members to form the smoking articles. By providing such a resistance to deformation with tubular members, the present 30 invention eliminates the need to use stiff, high basis weight plug wraps and tipping wrappers which might otherwise be required to prevent collapse of cavities. Such high basis weight plug wraps and tipping wrappers are undesirable since they can become creased or folded during manufacture of the filter rods and the smoking articles. High basis weight plug wraps and tipping wrappers can also add other costly steps to the manufacturing process, such as the 35 need for online laser perforation ventilation. Furthermore, high basis weight plug wraps and tipping wrappers can make it difficult for a consumer to deform the filter in order to break the

one or more capsules contained therein. By eliminating the need for such high basis weight plug wraps and tipping wrappers and by forming the mouth end cavity using a hollow tube segment, smoking articles produced in accordance with the present invention allow a consumer 5 to easily deform the filter at the second filter segment in order to break the one or more capsules contained therein, whilst ensuring the mouth end cavity is sufficiently resistant to deformation or collapse.

The continuous sheet of plug wrap used has a basis weight of less than about 90 gsm, preferably less than about 60 gsm, most preferably less than about 40 gsm. The plug wrap preferably has a basis weight of more than about 20 gsm.

10 In some embodiments, it may be desirable to include further segments of filtration material in each smoking article. Advantageously, the method according to the present invention can be adapted easily to accommodate such multiple segment filter rods by inserting the required number of additional filter segments between each first filter member and each tubular member. Regardless of the number of different filter segments used to form the 15 wrapped filter array, the filter segments adjacent to each end of each tubular member are preferably the same, that is they preferably have the same composition.

20 The filtration material within each filter segment is preferably a plug of fibrous filtration material, such as cellulose acetate tow or paper. A filter plasticiser may be applied to the fibrous filtration material in a conventional manner, by spraying it onto the separated fibres, preferably before applying any additional material to the filtration material. Smoking articles 25 made in accordance with the present invention may include a variety of different types of filter segments or combinations of filter segments that would be known to the skilled person, including restrictors and segments that are used for adjusting the resistance to draw (RTD). Alternatively, or in addition, smoking articles made in accordance with the present invention may include one or more segments containing carbon, preferably a rod end segment containing carbon.

30 In some cases, it may be desirable to provide the filter with means for releasing a flavourant or other additive on demand, usually via manual release by the consumer immediately prior to smoking the smoking article. Therefore, the method may further comprise a step of providing a flavorant containing material in a filter segment of the filter. The flavourant containing material may be added to the first filter segment. Additionally, or alternatively, the flavourant containing material may be added to the second filter segment.

35 In some embodiments, the flavourant containing material comprises the one or more breakable capsules contained within the second filter segment. Preferably, the second filter segment comprises the one or more breakable capsules dispersed within a fibrous filtration material.

In embodiments comprising a flavourant containing material, a filter segment incorporating the flavor containing material is preferably circumscribed by a plug wrap that is substantially impermeable to the flavourant additive. This advantageously inhibits transfer of the additive through the plug wrap to the outside of the filter, where it may undesirably come into contact with the consumer's fingers when the filter is incorporated into a smoking article.

To further improve the resistance of each tubular member to deformation during manufacture of the filter rods and the smoking articles, the wall of each tubular member preferably has a thickness of at least about 100 micrometres, more preferably at least about 150 micrometres. Alternatively, or in addition, the wall thickness is preferably less than about 500 micrometres, more preferably less than about 350 micrometres, most preferably less than about 250 micrometres.

Preferably, each tubular member has a length of at least about 4 mm. This not only provides a mouth end cavity of an appropriate size, but also ensures sufficient overlap between the tubular member and the plug wrap to maintain the tubular member in axial alignment with the adjacent filter segment. Additionally, or alternatively, each tubular member preferably has a length of less than about 30 mm.

In some embodiments, each tubular member may comprise a coating layer on an inner surface thereof. A coating layer can help to inhibit absorption of moisture into the tubular member during smoking of the smoking article, therefore maintaining the resistance of the mouth end cavity to deformation. Suitable coating materials include, but are not limited to, waxes, polymeric materials and combinations thereof. Particularly suitable waxes include vegetable waxes, and other particularly suitable materials are ethylcellulose and nitrocellulose.

In some embodiments, the tubular members may be formed from a polymeric material or a paper material. For example, the tubular members can be formed from extruded plastic tubes. Preferably, the tubular members are formed from a plurality of overlapping paper layers, such as a plurality of parallel wound paper layers or a plurality of spirally wound paper layers, which can further increase the resistance of the tubular members to deformation or collapse. Preferably each tubular member comprises at least two paper layers. Alternatively, or additionally, each tubular member preferably comprises fewer than eleven paper layers.

An exemplary method for forming a tubular member from a plurality of wound paper layers comprises wrapping a plurality of substantially continuous paper strips in an overlapping manner about a cylindrical mandrel. The strips are wrapped in a parallel manner or a spiral manner so as to form a substantially continuous tube on the mandrel. The formed tube may be turned about the mandrel, for example using a rubber belt, so that the paper layers are continually drawn and wrapped around the mandrel. The formed tube can then be cut into the required tubular members downstream of the mandrel.

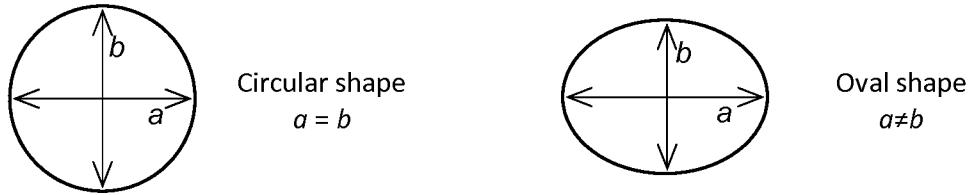
To inhibit the transfer of moisture from one paper layer to the next during smoking of the smoking article, adjacent paper layers of each tubular member are preferably adhered together by an intermediate layer of adhesive, which provides a barrier to the transfer of moisture between layers. This may be in addition to or as an alternative to a coating provided on an 5 inner surface of each tubular member, as described above. Such a coating may additionally, or alternatively, be provided between adjacent layers of the tubular member.

The first cutting step comprises cutting the wrapped filter array at an intermediate position along the length of each first filter member such that each filter rod comprises a single tubular member positioned between the two first filter segments. Each filter rod is used to produce two 10 smoking article filters by cutting the filter rod at an intermediate position along the length of the tubular member. Therefore, these filter rods may be known as dual filter rods.

The dual filter rods can be formed directly from the wrapped filter array by cutting consecutive first filter members. Alternatively, the cutting step may comprise a first step of cutting the wrapped filter array at an intermediate position along the length of every other first 15 filter member (that is, cutting a first filter member, not cutting the next first filter member, cutting the following first filter member, not cutting the next filter member, and so on) to form filter rods each comprising two tubular members positioned between two first filter segments and a single first filter member positioned between the two tubular members. Such filter rods may be known as quadruple filter rods. To form the smoking articles, the quadruple filter rods are cut at an 20 intermediate position along the length of the first filter member to form two dual filter rods, and the two dual filter rods are used to form four smoking articles.

Smoking articles formed in accordance with the methods described above may exhibit a difference between the ovality of the tube segment after a 50% deformation of the filter and the ovality of the tube segment prior to deformation of the filter of less than about 25%, preferably 25 less than about 20%. For example, where the ovality of the tube segment prior to deformation is 5%, the ovality of the tube segment after a 50% deformation of the filter is preferably less than 30%, more preferably less than 25%. The tube segment therefore provides a mouth end cavity which is resistant to collapse or deformation. The particular test procedure for conducting deformations of the filter in accordance with present invention is described in detail below.

30 The term "ovality" as used herein means the degree of deviation from a perfect circle. Ovality is expressed as a percentage and the mathematical definition is given below.



$$ovality (\%) = \frac{2(a - b)}{a + b} \times 100\%$$

To determine the ovality of a segment of a smoking article (such as the hollow tube segment), the mouth end is viewed along the longitudinal direction of the smoking article. For example, the smoking article can be positioned on its mouth end on a transparent stage so that an image of the mouth end of the article is recorded by a suitable imaging device located below the stage. Dimension "a" is taken to be the largest external diameter of the segment at its downstream end, and dimension "b" is taken to be the smallest external diameter of the segment at its downstream end. The process is repeated for a total of ten smoking articles having the same design and the number average of the ten ovality measurements is recorded as the ovality for that design of smoking article.

Since smoking article filters are generally circular in cross section, the ovality of the hollow tube segment after a 50% deformation is preferably less than about 25%, more preferably less than about 20%. In this case, the mouth end cavity of the smoking article retains or resumes a generally circular cross section, even after a 50% deformation of the filter. Alternatively, or in addition, the ovality of the tube segment after a 67% deformation of the filter is preferably less than about 35%, more preferably less than about 30%.

In some embodiments, the ovality of the hollow tube segment after a 50% deformation of the filter performed after the smoking article has been subjected to a smoking test is preferably less than about 35%, more preferably less than about 30%. Alternatively, or in addition, the ovality of the tube segment after a 67% deformation of the filter performed after the smoking article has been subjected to a smoking test is preferably less than about 45%, more preferably less than about 40%. This advantageously provides consistency in the ovality of the mouth end cavity during smoking of the smoking article.

The smoking test used for testing smoking articles in accordance with the present invention is described in detail below. Where it is necessary to measure the ovality after deformation tests performed both before and after smoking, two samples of smoking articles having the same design should be used. That is, a non-deformed un-smoked smoking article

should be used for the pre-smoking deformation test, and non-deformed articles having the same design are subjected to the smoking test and used for the post-smoking deformation test.

To increase the resistance of the hollow tube segment to crushing, the filter preferably has an un-smoked compressive strength of at least about 20 Newtons at 50% compression.

5 Alternatively, or in addition, the un-smoked compressive strength of the filter at 50% compression is preferably less than about 50 Newtons. The term "compressive strength" is a measure of the force required to provide a particular compression of the filter section of the smoking article. Compressive strength is measured using the compressive strength test described in detail below, where the compressive strength of a given smoking article design is

10 the number average of the compressive strength measurements for a sample of ten smoking articles having the same design.

Where the smoking article includes a filter segment comprising one or more breakable capsules as described above, the ovality of the tube segment is preferably less than 35%, more preferably less than 30%, after a capsule crush test in which a force corresponding to the crush strength of the one or more capsules is applied to the smoking article. The crush strength of a capsule corresponds to the compressive force required to break open the capsule and release the additive contained within the capsule when the capsule is disposed within the filter segment. The capsule crush test is described in detail below.

Where the capsule crush test is performed after the smoking article has been subjected to a smoking test, the ovality of the tube segment is preferably less than about 45%, more preferably less than about 40%, after the capsule crush test.

The tipping wrapper may comprise paper having a basis weight of less than about 70 gsm, preferably less than about 50 gsm. The tipping wrapper preferably has a basis weight of more than about 20 gsm.

25 Smoking articles produced in accordance with the present invention may be filter cigarettes or other smoking articles in which the tobacco material is combusted to form smoke. Alternatively, the smoking articles may be articles in which the tobacco material is heated to form an aerosol, rather than combusted. In one type of heated smoking article, the tobacco material is heated by one or more electrical heating elements to produce an aerosol. In another 30 type of heated smoking article, an aerosol is produced by the transfer of heat from a combustible or chemical heat source to a physically separate tobacco material, which may be located within, around or downstream of the heat source. The present invention further encompasses smoking articles in which a nicotine-containing aerosol is generated from a tobacco material without combustion or heating.

## Test Procedures

### *Deformation and compressive strength test*

5 The smoking article to be tested is positioned between a flat surface and a circular plate opposed to the flat surface, the circular plate having a diameter of 10 mm. The edge of the circular plate closest to the mouth end of the smoking article is positioned 8 mm from the mouth end. The filter is then compressed by moving the circular plate towards the flat surface at a constant speed of 100 mm per second. The force applied by the circular plate is increased until

10 the desired deformation of the portion of the smoking article between the circular plate and the flat surface is achieved. For example, to achieve a 50% deformation, the compressed portion of the smoking article is compressed to a diameter of 50% of the diameter of that portion prior to compression. Similarly, to achieve a 67% deformation, the smoking article is compressed until the compressed portion is reduced to a diameter of 33% of the diameter of that portion prior to

15 compression. The diameter is measured in the direction of compression, which is the direction extending between the flat surface and the circular plate. Once the desired compression has been achieved, the force required to provide that compression is noted as the compressive strength of the filter. The circular plate is then retracted so that the compressive force is removed. The smoking article is left for 30 seconds to expand before any further tests or

20 measurements are performed.

### *Smoking test*

25 To simulate the smoking of a smoking article, the smoking article is subjected to a standard smoking test under ISO conditions (35ml puffs lasting 2 seconds each, every 60 seconds). In the ISO test method, the smoking article is smoked with the ventilation zone fully uncovered.

### *Capsule crush test*

30 To perform a capsule crush test in accordance with the present invention, a smoking article including a breakable capsule is positioned between a lower plate having a diameter of 150 mm and an upper plate having a diameter of 20 mm. The portion of the smoking article housing the breakable capsule is positioned between the two plates such that the plates are centred on the location of the capsule. The smoking article and the capsule are then compressed by moving

35 the upper plate towards the lower plate at a constant speed of 30 mm per minute. The force applied by the upper plate is increased until the capsule breaks, at which point the maximum

compressive load applied by the upper plate is recorded as the crush strength of the capsule. The test is terminated when the maximum compressive load is reached and the upper plate is then retracted to remove the compressive force from the smoking article. The smoking article is left for 30 seconds to expand before any further tests or measurements are performed, such as 5 ovality measurements.

The invention will now be further described, by way of example only, with reference to the accompanying drawings in which:

10 Figure 1 shows a method of forming a plurality of smoking article filter rods, in accordance with the present invention;

Figure 2 shows a dual filter rod;

Figure 3 shows a quadruple filter rod;

15 Figure 4 shows an exemplary method of forming a smoking article using a dual filter rod, in accordance with the present invention;

Figure 5 shows a smoking article made in accordance with the method shown in Figure 4;

Figure 6 shows the mouth end of the smoking article of Figure 5 with the filter unwrapped; and

Figure 7 shows an exemplary method of forming a tubular member.

20 Figure 1 illustrates a process for forming a plurality of smoking article filter rods in accordance with the invention. A substantially continuous array of filter components is formed by providing a plurality of tubular members 40, a plurality of flavour containing filter segments 20 and a plurality of rod end filter members 42. A tubular member 40 is provided between each 25 pair of consecutive rod end filter members 42, and a flavour containing filter segment 20 is provided between each rod end filter member 42 and each tubular member 40. The substantially continuous array of filter components is then wrapped in a continuous sheet of plug wrap 44 to form a wrapped filter array.

30 To form a plurality of filter rods, a plurality of first cuts 46 is made through at least some of the rod end filter members 42 of the wrapped filter array, each first cut 46 positioned at an intermediate position along the length of the respective rod end filter member 42. The resilience of each tubular member 40 advantageously prevents collapse of the cavities defined therein during the cutting process and subsequent handling of the filter rods and any smoking articles incorporating filters manufactured from the filter rods.

35 To form a dual filter rod, as shown in Figure 2, the wrapped filter array is cut through each rod end filter member 42 so as to provide a filter rod having a rod end filter segment 18 at each

end, two flavor containing filter segments 20 positioned between the two rod end filter segments 18, and a tubular member 40 positioned between the two flavor containing filter segments 20. The dual filter rod essentially defines two smoking article filters 14 which are joined by a continuous plug wrap 44 and a tubular member 40.

5 Alternatively, a quadruple filter rod, as shown in Figure 3, can be formed by cutting the wrapped filter array through every other filter member 42 so as to provide a filter rod which essentially comprises two joined dual filter rods.

10 The formed filter rods are used to form two or more smoking articles. For example, as shown in Figure 4, a dual filter rod can be used to form two filter cigarettes 10 by placing a tobacco rod 12 in axial alignment with each end of the filter rod. A tipping wrapper 50 is then wrapped around the filter rod and a portion of each tobacco rod 12 adjacent the filter rod. The tipping wrapper 50, the plug wrap 44 and the tubular member 40 are then cut along a cut line 52 to form two filter cigarettes. The resilience of the tubular member 40 prevents collapse or deformation of the mouth end cavities of each cigarette 10 during the cutting process.

15 As shown in Figures 5 and 6, each filter cigarette 10 comprises a wrapped rod 12 of tobacco cut filler which is attached at one end to an axially aligned filter 14. A tipping wrapper 16 formed from tipping wrapper 50 circumscribes the filter 14 and a portion of the wrapped rod 12 of tobacco to join together the two portions of the cigarette 10.

20 As shown in Figure 6, the filter 14 comprises the rod end filter segment 18, the flavour containing filter segment 20, and a mouth end hollow tube segment 22 formed from part of a tubular member 40. The segments 18, 20 and 22 are circumscribed by a combining plug wrap 23 formed from the continuous sheet of plug wrap 44, the combining plug wrap 23 connecting the three segments to form the filter 14.

25 The rod end filter segment 18 and the flavour containing filter segment 20 are formed of a suitable filtration material, such as cellulose acetate tow. Furthermore, the flavour containing filter segment 20 comprises a suitable flavourant, which may be provided in the form of one or more breakable capsules contained within the flavour containing filter segment 20. In this case, the one or more breakable capsules are ruptured by the consumer when desired by squeezing the flavour containing filter segment 20 between the consumer's fingers.

30 The mouth end hollow tube segment 22 defines a mouth end cavity 24 in the filter 14 which extends between the downstream end of the flavour containing filter segment 20 and the mouth end edge of the filter 14. The mouth end hollow tube segment 22 provides sufficient mechanical strength and resilience to resist deformation of the mouth end cavity 24, for example during the rupture of the one or more breakable capsules when present in the flavour containing filter segment 20.

Figure 7 shows an exemplary method of forming a continuous tube 30 which can be cut to form a plurality of tubular members 40. To form the continuous tube 30, a plurality of continuous paper plies 32 are spirally wound around a cylindrical mandrel 34 in a staggered, overlapping arrangement. A suitable adhesive may be applied to one or more of the plies 32 using an adhesive bath 36 prior to winding each ply around the mandrel 34. The plies 32 are driven by a rubber belt 38 so that the continuous tube 30 rotates around the mandrel 34 until it is cut into desired lengths further downstream.

5

**Claims**

1. A method of producing smoking articles, the method comprising the steps of:  
providing a continuous array of first filter members, second filter segments and tubular  
members, wherein a tubular member is provided between each pair of consecutive first filter  
members and wherein a second filter segment is provided between each first filter member and  
each tubular member, each second filter segment containing one or more breakable capsules,  
each breakable capsule comprising an outer shell and an inner core containing an additive;

5 members, wherein a tubular member is provided between each pair of consecutive first filter  
members and wherein a second filter segment is provided between each first filter member and  
each tubular member, each second filter segment containing one or more breakable capsules,  
each breakable capsule comprising an outer shell and an inner core containing an additive;  
wrapping the continuous array of first filter members, second filter segments and tubular  
members with a continuous sheet of plug wrap to form a wrapped filter array, wherein the plug  
wrap has a basis weight of less than 90 grams per square metre;

10 cutting the wrapped filter array at an intermediate position along each first filter member  
to provide multiple filter rods, each filter rod comprising two first filter segments, a tubular  
member positioned between the first filter segments and a second filter segment provided  
15 between each first filter segment and the tubular member;

providing a tobacco rod in axial alignment with and adjacent to each first filter segment  
of a filter rod;

wrapping the filter rod and a portion of each tobacco rod in a tipping wrapper; and

20 cutting the tipping wrapper and the filter rod at an intermediate position along the length  
of the tubular member to form multiple smoking articles, each smoking article comprising a  
tobacco rod connected to a filter, wherein each filter comprises a first filter segment downstream  
of the tobacco rod, a second filter segment downstream of the first filter segment, and a hollow  
tube segment positioned between the second filter segment and the mouth end of the filter, the  
hollow tube segment defining a cavity at the mouth end of the filter.

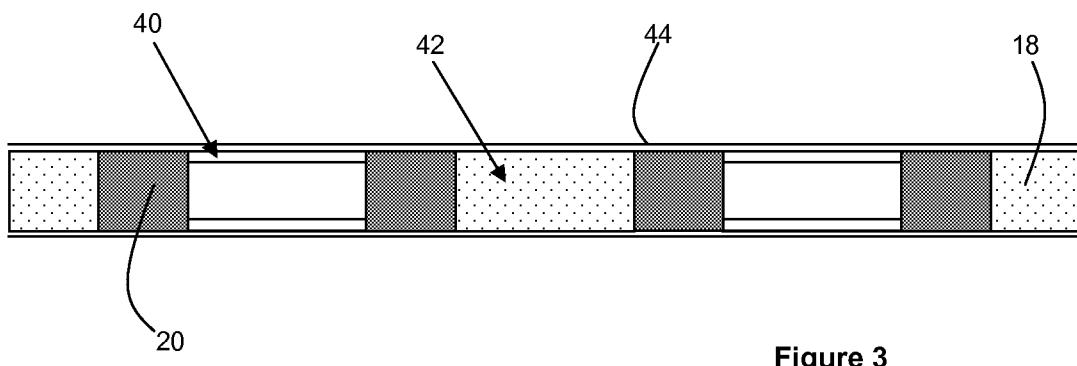
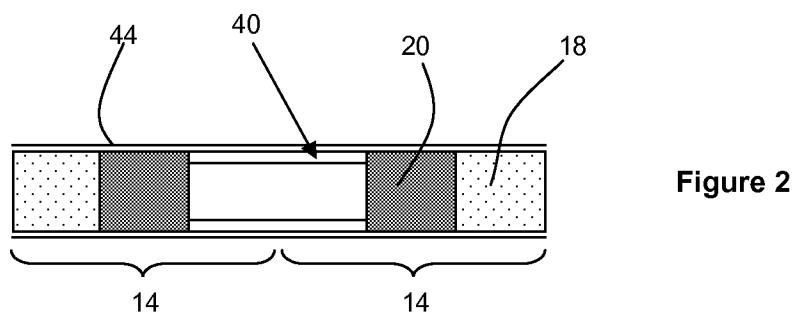
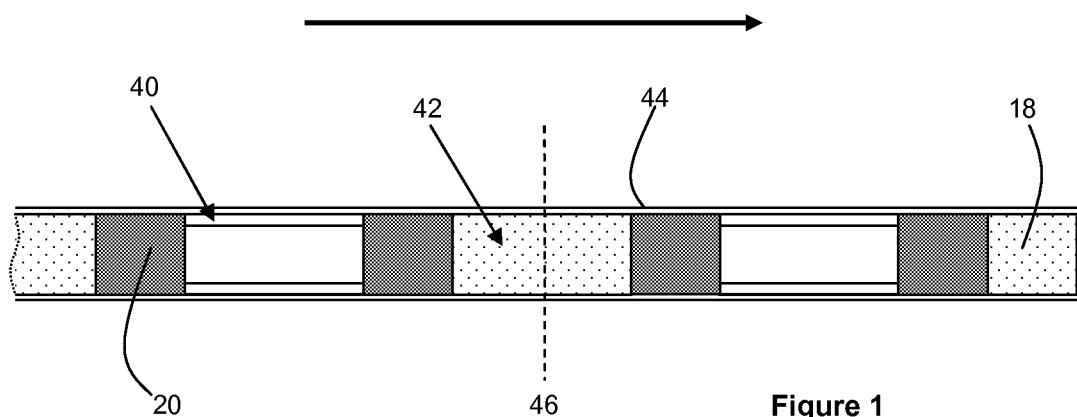
25 2. A method according to claim 1, further comprising providing a segment plug wrap  
circumscribing each second filter segment, wherein each segment plug wrap is substantially  
impermeable to the additive in the inner core of the one or more breakable capsules.

30 3. A method according to claim 1 or 2, wherein the wall of each tubular member has a  
thickness of between 150 micrometres and 500 micrometres.

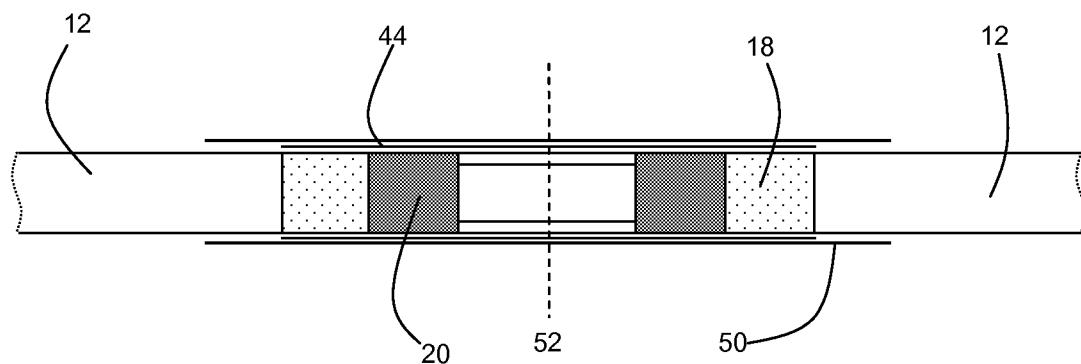
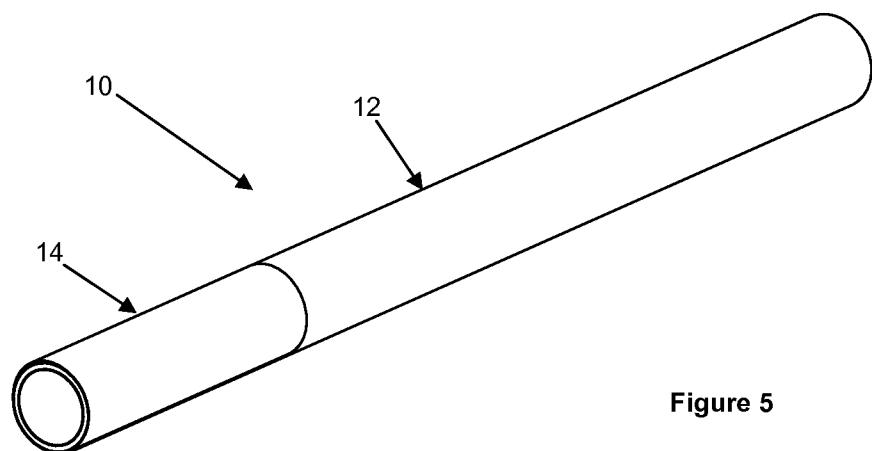
4. A method according to any preceding claim wherein each tubular member has a length  
of at least 4 mm.

5. A method according to any preceding claim, wherein each tubular member comprises a coating layer on an inner surface thereof.
6. A method according to any preceding claim, wherein each tubular member is formed of 5 a plurality of overlapping paper layers.
7. A method according to claim 6, wherein adjacent paper layers of each tubular member are adhered together by an intermediate layer of an adhesive.
- 10 8. A method according to claim 6 or 7, wherein each tubular member comprises at least two paper layers.
9. A smoking article produced according to the method of any preceding claim, wherein the difference between the ovality of the tube segment after 50% deformation of the filter and the 15 ovality of the tube segment prior to deformation of the filter is less than 25%.
10. A smoking article produced according to the method of any preceding claim, wherein the ovality of the hollow tube segment after a 50% deformation of the filter is less than 25%.
- 20 11. A smoking article produced according to the method of any preceding claim, wherein the compressive strength of the hollow tube segment is at least 20 Newtons at 50% compression.

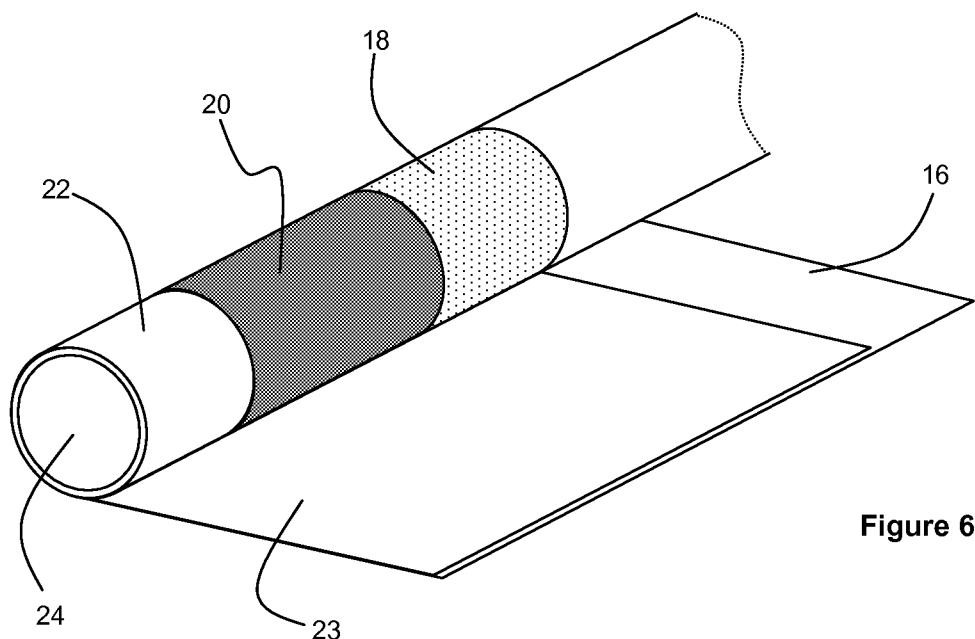
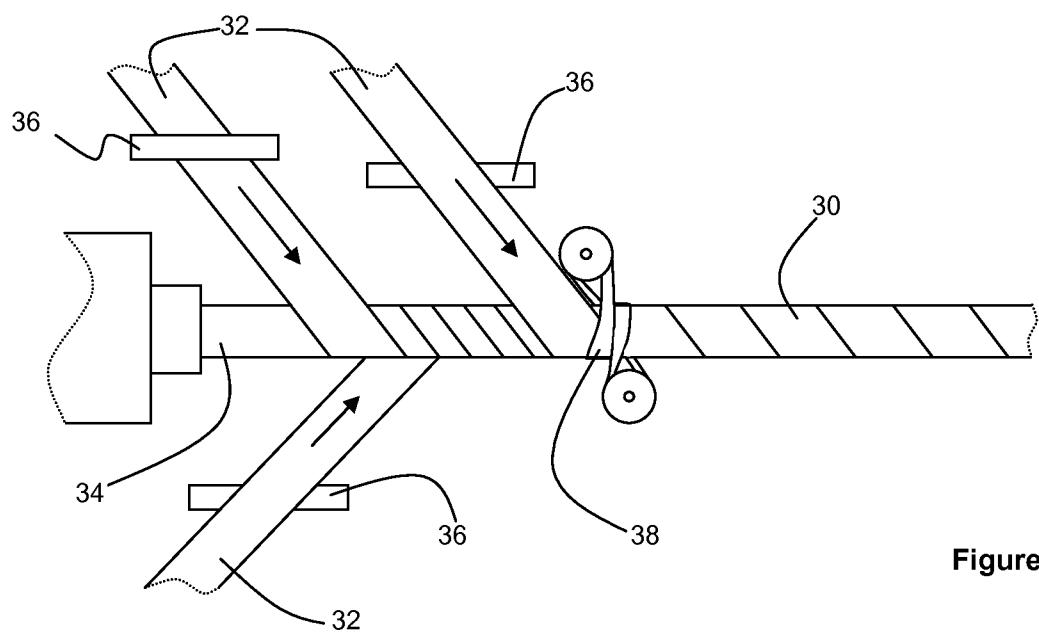
1/3



2/3

**Figure 4****Figure 5**

3/3

**Figure 6****Figure 7**

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2013/065330

A. CLASSIFICATION OF SUBJECT MATTER				
INV.	A24C5/47	A24D3/02	A24D3/04	A24D1/02
ADD.				A24D3/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24C A24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 979 058 A (SCHUR MILTON O) 11 April 1961 (1961-04-11) column 2, line 9 - column 3, line 10; figures -----	1-11
X	WO 2007/110650 A1 (PHILIP MORRIS PROD [CH]; LI SAN [US]; OLEGARIO RAQUEL [US]; BRAUNSHEY) 4 October 2007 (2007-10-04) page 4, line 31 - page 7, line 11; figures page 12, line 7 - page 13, line 34; claims -----	1
X	WO 02/03819 A1 (PHILIP MORRIS PROD [CH]; LECOULTRE ETIENNE [CH]; BADERTSCHER THOMAS [C] 17 January 2002 (2002-01-17) page 12, line 31 - page 15, line 5; figures ----- -/-	1

Further documents are listed in the continuation of Box C.

See patent family annex.

### \* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 January 2014	27/01/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Marzano Monterosso

## INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/065330

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 308 833 A (GEORGE DEARSLEY) 14 March 1967 (1967-03-14) column 8, line 56 - column 9, line 34; figures 13-16 -----	1-11
A	GB 862 676 A (KURT KOERBER) 15 March 1961 (1961-03-15) the whole document -----	1-11
A	WO 2011/152316 A1 (JAPAN TOBACCO INC [JP]; NODA KAZUHIRO [JP]; NAKAGAWA YASUHIRO [JP]; YO) 8 December 2011 (2011-12-08) abstract; claims; figures & EP 2 578 093 A1 (JAPAN TOBACCO INC [JP]) 10 April 2013 (2013-04-10) -----	2

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/065330

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 2979058	A 11-04-1961	BE 665211 A		01-10-1965
		DE 1140501 B		29-11-1962
		FR 1189692 A		06-10-1959
		GB 873982 A		02-08-1961
		US 2979058 A		11-04-1961
WO 2007110650	A1 04-10-2007	AU 2007231147 A1		04-10-2007
		BR PI0709264 A2		28-06-2011
		CN 101442917 A		27-05-2009
		CO 6140007 A2		19-03-2010
		EA 200870378 A1		28-08-2009
		EP 2007233 A1		31-12-2008
		JP 2009531052 A		03-09-2009
		KR 20090008277 A		21-01-2009
		NZ 571453 A		30-09-2011
		US 2007235050 A1		11-10-2007
		US 2011100388 A1		05-05-2011
		WO 2007110650 A1		04-10-2007
WO 0203819	A1 17-01-2002	AT 379979 T		15-12-2007
		AU 5984500 A		21-01-2002
		BR 0017260 A		10-04-2007
		CA 2416144 A1		17-01-2002
		CN 1454062 A		05-11-2003
		EP 1299012 A1		09-04-2003
		ES 2298151 T3		16-05-2008
		HK 1058886 A1		21-04-2006
		JP 4594584 B2		08-12-2010
		JP 2004516814 A		10-06-2004
		MX PA03000390 A		13-09-2004
		PT 1299012 E		08-04-2008
		US 7243659 B1		17-07-2007
		WO 0203819 A1		17-01-2002
US 3308833	A 14-03-1967	NONE		
GB 862676	A 15-03-1961	NONE		
WO 2011152316	A1 08-12-2011	CA 2801198 A1		08-12-2011
		CN 102933104 A		13-02-2013
		EP 2578093 A1		10-04-2013
		KR 20130012585 A		04-02-2013
		TW 201204275 A		01-02-2012
		US 2013081644 A1		04-04-2013
		WO 2011152316 A1		08-12-2011