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.

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 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 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 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, 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.

According to one aspect, there is provided 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, the tubular member being formed from a plurality of spirally wound paper layers, wherein adjacent paper layers are adhered together by an intermediate layer of an adhesive, 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;

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 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

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.

~~Accordingly, the present invention provides~~Herein disclosed is 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 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

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~~As mentioned in the above aspect, 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 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 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 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 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 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.

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.

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, the tubular member being formed from a plurality of spirally wound paper layers, wherein adjacent paper layers are adhered together by an intermediate layer of an adhesive, 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;

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 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

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.

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.

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 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.~~

~~8.~~6. A method according to any preceding claim ~~6 or 7~~, wherein each tubular member comprises at least two paper layers.

~~9.~~7. 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 ovality of the tube segment prior to deformation of the filter is less than 25%.

~~10.~~8. 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%.

~~11.~~9. 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.