

(19)



(11)

EP 3 747 284 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

09.12.2020 Bulletin 2020/50

(51) Int Cl.:

A24D 3/04 (2006.01)

A24D 3/02 (2006.01)

(21) Application number: **20157599.0**

(22) Date of filing: **17.02.2020**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

(30) Priority: **16.10.2019 GB 201914962**

14.02.2020 JP 2020023306

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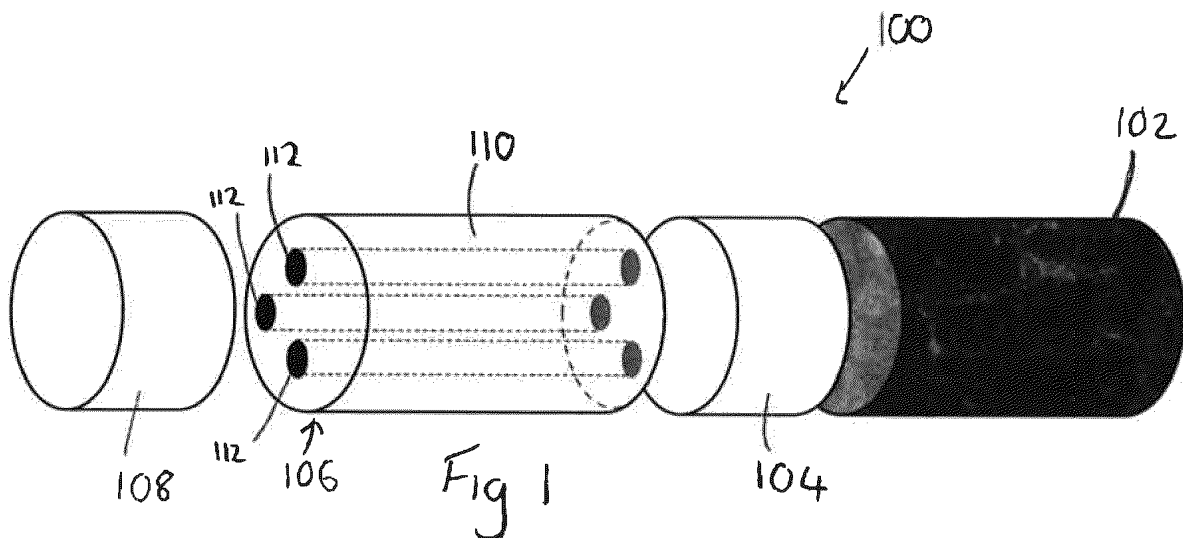
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Remarks:

Amended claims in accordance with Rule 137(2)
EPC.

(54) **A COOLING ELEMENT**

(57) The present invention provides a cooling element (106) comprising a longitudinally extending core (110) including three longitudinally extending bores (112).



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Description

INTRODUCTION

[0001] The present invention provides a cooling element for use with a smoking article such as a tobacco heated product or a heat-not-burn product.

BACKGROUND

[0002] Tobacco heated products or heat-not-burn (HNB) products are well known. The idea of a tobacco heated product is that the tobacco is heated to a specific temperature (such as 350°C) without burning. This delivers a vapour containing nicotine but it is believed that heating without burning avoids creation of combustion products that are harmful to the consumer.

[0003] Tobacco heating products (HNB products) may include a plug of modified tobacco and other mouthpiece elements which are wrapped in a paper plugwrap so as to provide a cigarette-like appearance. In one such product a reconstituted tobacco plug, a wrapped hollow acetate tube, a wrapped plug of PLA [poly(lactic acid)] and a conventional wrapped acetate segment are wrapped in a white paper. The product may then be inserted into a heating element which heats the tobacco so the product can then be "smoked" by the consumer. The function of the "filter" in these products is very different from that of a cigarette filter; the main functions are to provide the look and feel of a cigarette and also to cool the smoke down to an acceptable temperature for the consumer. In the product described above it is the PLA section which performs the significant cooling function and so it may be considered a cooling element.

[0004] The PLA segment has drawbacks in terms of availability, manufacturing capability, filtration properties (particularly in relation to phenols), sensation, firmness, biodegradability and appearance. Previous cooling elements may also have drawbacks in terms of their ability to cool smoke down to an acceptable or predictable level. Consequently, there is a need for a cooling element that provides acceptable cooling of the vapor in a HNB product without the drawbacks seen when using PLA for the cooling element. It is also desirable to provide cooling elements having consistent and/or predictable cooling effect to provide the required temperature reduction.

SUMMARY OF THE INVENTION

[0005] According to the present invention in a first aspect there is provided a cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) comprising a longitudinally extending (e.g. cylindrical) core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of greater than or equal to 0.8 mm).

[0006] The applicants have found that a cooling element that comprises a plurality of bores, together with

other components (e.g. other discrete segments) of a HNB mouthpiece, can provide an appropriate level of cooling of the vapour. The applicants have found that by varying the size, shape and arrangement of the bores they are able to better control the airflow in the HNB product and therefore able to tailor the cooling effect to provide the required temperature reduction.

[0007] Preferably each bore has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm. The applicants have found that bores having these diameters may provide optimal cooling characteristics. It will be appreciated that the cooling element may comprise a plurality of bores of different diameters. The cooling element may include from 2 to 12 bores. Preferably the cooling element includes from 2 to 6 bores. Preferably the cooling element includes 2, 3, 4, 5 or 6 bores. Preferably the cooling element includes 4 to 6 bores. Preferably the cooling element includes 3, 4 or 5 bores. The applicants have found that a cooling element that includes 3, 4 or 5 bores may provide optimal cooling of the vapour.

[0008] It will be appreciated that the term "bore" as used herein refers to a tunnel or enclosed channel running longitudinally through the core which is enclosed by the core (but which may be open at one or both ends of the core). The cross section of each bore may be any shape (i.e. the bores do not have to be circular in shape).

[0009] For a circular bore the term "diameter" has its usual meaning. It will be appreciated that for a non circular bore, the term "diameter" is taken to mean the length of a line passing through the centre of the bore from one side of the bore to another side of the bore at the broadest point of the bore. Preferably the (or each) bore is of uniform axial cross section.

[0010] According to the present invention in an aspect there is provided a cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) comprising a longitudinally extending (e.g. cylindrical) core including 3 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of greater than or equal to 0.8 mm). Preferably each bore has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm.

[0011] According to the present invention in an aspect there is provided a cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) comprising a longitudinally extending (e.g. cylindrical) core including 4 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of greater than or equal to 0.8 mm). Preferably each bore has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm.

[0012] According to the present invention in an aspect there is provided a cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) comprising a longitudinally extending (e.g. cylindrical) core including 5 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of

greater than or equal to 0.8 mm). Preferably each bore has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm.

[0013] The cooling element may be made from natural or synthetic filamentary tow, e.g. of cotton or plastics such as polyethylene or polypropylene, or cellulose acetate filamentary tow. The filtering material may be a thermoplastic or otherwise spinnable polymer, for example polypropylene, polyethylene terephthalate or polylactide.

[0014] Preferably the cooling element is made from cellulose acetate. Preferably the cooling element is thermoformed from cellulose acetate. The cellulose acetate may further comprise plasticiser (e.g. triacetin, triethyleneglycol diacetate (TEGDA), polyethylene glycol (PEG) or other plasticiser, or a mixture of plasticisers). The plasticiser (e.g. triacetin), if present, may be applied to the cellulose acetate material in an amount from 15% to 21.5%, preferably 15% to 19%, by total weight of cellulose acetate material. The applicants have found that the cellulose acetate cooling element, together with other components (e.g. other discrete segments) of the mouthpiece, may provide appropriate cooling, while providing satisfactory appearance and feel (e.g. including mouth-feel) to the consumer. This is particularly surprising given the conventional wisdom that cellulose acetate segments are not able to perform effective cooling. The applicants have found that by using conventional tobacco filtering materials such as thermoformed cellulose acetate to produce the cooling element of the present invention the cooling element can provide improved sensory characteristics (such as taste and feel) as well as reduced manufacturing costs compared to conventional cooling elements.

[0015] Preferably the length of the cooling element is from 5 to 50 mm, for example from 10 to 30mm, e.g. 8 to 24 mm, e.g. 15 to 20mm, e.g. 18 mm.

[0016] Preferably the circumference of the cooling element is from 12 to 30 mm, e.g. 15 to 28 mm, more preferably 17 to 25 mm, e.g. 18 to 25 mm, e.g. 20 to 24 mm, e.g. 22 to 24 mm, e.g. 23 mm, e.g. 22 mm.

[0017] Preferably the longitudinally extending core (e.g. of cellulose acetate material) is of uniform axial cross section.

[0018] Preferably each bore has a substantially circular cross section. Alternatively, the cross section of each bore may be of a different shape [circular, semi-circular (D-shaped), square, triangular, hollow star shaped, trilobal, pentagonal or cog-shaped cross-section, or of a cross-section in the shape of a logo or other pattern]. A cooling element according to the present invention may comprise a plurality of bores that have different shaped cross sections e.g. a cooling element comprising a bore of circular cross section and a bore of square cross section. This can be seen in e.g. Fig 3.

[0019] Preferably the cooling element has a substantially circular cross section meaning the cooling element is substantially cylindrical in shape. However, the cooling element of the present invention may be any shape. For

example, the cooling element may have an oval cross section or a square cross section or a rectangular cross section.

[0020] Preferably, each bore extends longitudinally through the full length of the core.

[0021] The cooling element may further comprise an outer wrapper engaged around the longitudinally extending core. The outer wrapper may be a paper (e.g. plug-wrap), preferably a paper (e.g. plugwrap) of basis weight 20 to 160 gsm, for example a paper (e.g. plugwrap) of basis weight 24 to 150 gsm, for example a paper (e.g. plugwrap) of basis weight 70 to 150 gsm, for example a paper (e.g. plugwrap) of basis weight 70 to 140 gsm.

[0022] According to the present invention there is provided a method of making a cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) comprising a step of passing (e.g. pulling) a (e.g. cellulose acetate) material to which plasticiser has already been applied through a shaping means (e.g. a fix die) while heat treating the material to thereby form a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of greater than or equal to 0.8 mm). Preferably the shaping means includes at least one protruding inner rod (mandrel) comprising a plurality of pins that each have a cross sectional profile equal to the cross section of a longitudinally extending bore.

[0023] The cooling element (e.g. a cooling element for a tobacco heated product and/or HNB product) may be manufactured by pulling a continuous bundle of cellulose acetate, optionally with plasticizer (e.g. triacetin) already applied thereto, through a fix die having an external diameter approximately equal to that of the desired external diameter of the cooling element to be produced. The plasticiser (e.g. triacetin) may be applied to the cellulose acetate material in an amount from 15% to 21.5%, preferably 15% to 19% by total weight of cellulose acetate material. The fix die includes a number of protruding inner rods (e.g. mandrels) extending through the fix die. The mandrel size (e.g. diameter) may be from 0.8 mm to 4.2 mm. The mandrel will have a circular cross section consisting of a number of pins having a diameter from 0.8 to 4.2 mm (depending on the size (e.g. diameter) of the bores required). When the cellulose acetate is pulled through the die, it passes around the mandrels (and thus around the pins) such that on exiting the die, a cooling element is formed having multiple bores having a cross-sectional profile equivalent to that of the number and size of the pins used in the mandrel. Heated steam (that is superheated steam, as is known in the art) may be applied to the cellulose acetate whilst it is in the die. The heated steam may be applied via a duct in the die. The heated steam cures the plasticiser applied to the cellulose acetate, allowing the cooling element to maintain the shape of the die after exiting the die. Preferably, the method includes a step wherein the cellulose acetate is exposed to cooling air after formation of the longitudinally

extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm (i.e. a diameter of greater than or equal to 0.8 mm). Preferably the cooling air is at temperature of 20°C to 26°C, more preferably the cooling air is at temperature of 22°C to 25°C, from example 22°C to 24.5°C. Preferably the method includes a step of extending the dwell time in the cooling air (e.g. provision of four or more air boxes through which the cooling element passes). The dwell time in the cooling air may be from 0.12 to 0.14 seconds, for example 0.13 seconds.

[0024] According to the present invention there is provided a cooling element for a tobacco heating product and/or HNB product comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

[0025] According to the present invention there is provided cooling element for a tobacco heating product and/or HNB product comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

[0026] According to the present invention there is provided a smoking article (e.g. Tobacco Heating Product, HNB product) comprising a cooling element as herein described and claimed below. It will be appreciated that the smoking article (e.g. Tobacco Heating Product, HNB product) may comprise one or more discrete further segments. The discrete further segments may be (e.g. cylindrical) plugs of tobacco smoke filtering material. Preferably the discrete further segments are made from cellulose acetate tow.

[0027] It will be appreciated that the cooling element may be used in any multi-segment filter or consumable. The filter construction could be two, three, four or more discrete segments. The filter may be attached to a tobacco rod (which can be made from any form of tobacco (including reconstituted). The filter may include other segments that include capsules, carbon, CPS, tubes, acetate, paper, menthol etc..

[0028] According to the present invention there is provided a tobacco heating product and/or HNB product comprising a cooling element comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

[0029] According to the present invention there is provided a tobacco heating product and/or a HNB product comprising a cooling element comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

[0030] Preferably the tobacco heating product and/or HNB product according to the present invention further comprising one or more discrete further segments. The discrete further segments may be (e.g. cylindrical) plugs of tobacco smoke filtering material. Preferably the discrete further segments are made from cellulose acetate tow.

[0031] The applicants have found that a cooling ele-

ment that comprises a plurality of bores, together with other components (e.g. other discrete segments) of a HNB mouthpiece, can provide an appropriate level of cooling of the vapour in the tobacco heating product and/or HNB product. The applicants have found that by varying the size, shape and arrangement of the bores they are able to better control the airflow in the tobacco heating product and/or HNB product and therefore able to tailor the cooling effect to provide the required temperature reduction.

[0032] Preferably each bore of the cooling element has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm. The applicants have found that bores having these diameters may provide optimal cooling characteristics. It will be appreciated that the cooling element may comprise a plurality of bores of different diameters. The cooling element may include from 2 to 12 bores. Preferably the cooling element includes from 2 to 6 bores. Preferably the cooling element includes 2,3,4,5 or 6 bores. Preferably the cooling element includes from 4 to 6 bores. Preferably the cooling element includes 3, 4 or 5 bores. The applicants have found that a cooling element that includes 3, 4 or 5 bores may provide optimal cooling of vapour in the tobacco heating product and/or HNB product.

[0033] Preferably the cooling element is made from cellulose acetate. Preferably the cooling element is thermoformed from cellulose acetate. The cellulose acetate may further comprise plasticiser (e.g. triacetin, triethyleneglycol diacetate (TEGDA), polyethylene glycol (PEG) or other plasticiser, or a mixture of plasticisers). The plasticiser (e.g. triacetin), if present, may be applied to the cellulose acetate material in an amount from 15% to 21.5%, preferably 15% to 19%, by total weight of cellulose acetate material. The applicants have found that the cellulose acetate cooling element, together with other components of the mouthpiece, may provide appropriate cooling of the vapour in the tobacco heating product and/or HNB product while providing satisfactory appearance and feel (e.g. mouthfeel) to the consumer. This is particularly surprising given the conventional wisdom that cellulose acetate segments are not able to perform effective cooling.

[0034] Preferably the length of the cooling element is from 5 to 50 mm, for example from 10 to 30mm, e.g. 8 to 24 mm, e.g. 15 to 20mm, e.g. 18 mm.

[0035] Preferably the circumference of the cooling element is from 12 to 30 mm, e.g. 15 to 28 mm, more preferably 17 to 25 mm, e.g. 18 to 25 mm, e.g. 20 to 24 mm, e.g. 22 to 24 mm, e.g. 23 mm, e.g. 22 mm.

[0036] The cross section of each bore of the cooling element may be any shape. Preferably each bore has a substantially circular cross section. Alternatively, the cross section of each bore may be of a different shape [circular, semi-circular (D-shaped), square, triangular, hollow star shaped, trilobal, pentagonal or cog-shaped cross-section, or of a cross-section in the shape of a logo or other pattern]. A cooling element according to the

present invention may comprise a plurality of bores that have different shaped cross sections e.g. a cooling element comprising a bore of circular cross section and a bore of square cross section. This can be seen in e.g. Figure 3.

[0037] Preferably the cooling element has a substantially circular cross section meaning the cooling element is substantially cylindrical in shape. However, the cooling element of the present invention may be any shape. For example, the cooling element may have an oval cross section or a square cross section or a rectangular cross section.

[0038] Preferably, each bore of the cooling element extends longitudinally through the full length of the core.

[0039] According to the present invention in a further aspect there is provided the use, in a tobacco heated product and/or HNB product, of a cooling element comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

[0040] According to the present invention in a further aspect there is provided the use, in a tobacco heated product and/or HNB product, of a cooling element comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

[0041] Preferably the tobacco heating product and/or HNB product according to the present invention further comprising one or more discrete further segments. The discrete further segments may be (e.g. cylindrical) plugs of tobacco smoke filtering material. Preferably the discrete further segments are made from cellulose acetate tow.

[0042] The applicants have found that a cooling element that comprises a plurality of bores, together with other components (e.g. other discrete segments) of a HNB mouthpiece, can provide an appropriate level of cooling of the vapour in the tobacco heating product and/or HNB product. The applicants have found that by varying the size, shape and arrangement of the bores they are able to better control the airflow in the tobacco heating product and/or HNB product and therefore able to tailor the cooling effect to provide the required temperature reduction. Preferably each bore of the cooling element has a diameter from 0.8 mm to 2.5 mm. Preferably each bore has a diameter from 1.5 mm to 2.5 mm. The applicants have found that bores having these diameters may provide optimal cooling characteristics. It will be appreciated that the cooling element may comprise a plurality of bores of different diameters. The cooling element may include from 2 to 12 bores. Preferably the cooling element includes from 2 to 6 bores. Preferably the cooling element includes 2, 3, 4, 5 or 6 bores. Preferably the cooling element includes 3, 4 or 5 bores. Preferably the cooling element includes from 4 to 6 bores. The applicants have found that a cooling element that includes 3, 4 or 5 bores may provide optimal cooling of vapour in the tobacco heating product and/or HNB product.

[0043] Preferably the cooling element is made from

cellulose acetate. Preferably the cooling element is thermoformed from cellulose acetate. The cellulose acetate may further comprise plasticiser (e.g. triacetin, triethylenglycol diacetate (TEGDA), polyethylene glycol (PEG) or other plasticiser, or a mixture of plasticisers). The plasticiser (e.g. triacetin), if present, may be applied to the cellulose acetate material in an amount from 15% to 21.5%, preferably 15% to 19%, by total weight of cellulose acetate material. The applicants have found that the cellulose acetate cooling element, together with other components of the mouthpiece, may provide appropriate cooling of the vapour in the tobacco heating product and/or HNB product while providing satisfactory appearance and feel (e.g. mouthfeel) to the consumer. This is particularly surprising given the conventional wisdom that cellulose acetate segments are not able to perform effective cooling.

[0044] Preferably the length of the cooling element is from 5 to 50 mm, for example from 10 to 30mm, e.g. 8 to 24 mm, e.g. 15 to 20mm, e.g. 18 mm.

[0045] Preferably the circumference of the cooling element is from 12 to 30 mm, e.g. 15 to 28 mm, more preferably 17 to 25 mm, e.g. 18 to 25 mm, e.g. 20 to 24 mm, e.g. 22 to 24 mm, e.g. 23 mm, e.g. 22 mm.

[0046] The cross section of each bore of the cooling element may be any shape. Preferably each bore has a substantially circular cross section. Alternatively, the cross section of each bore may be of a different shape [circular, semi-circular (D-shaped), square, triangular, hollow star shaped, trilobal, pentagonal or cog-shaped cross-section, or of a cross-section in the shape of a logo or other pattern]. A cooling element according to the present invention may comprise a plurality of bores that have different shaped cross sections e.g. a cooling element comprising a bore of circular cross section and a bore of square cross section. This can be seen in e.g. Figure 3.

[0047] Preferably the cooling element has a substantially circular cross section meaning the cooling element is substantially cylindrical in shape. However, the cooling element of the present invention may be any shape. For example, the cooling element may have an oval cross section or a square cross section or a rectangular cross section..

[0048] Preferably, each bore of the cooling element extends longitudinally through the full length of the core.

[0049] The present invention will now be discussed in further detail with reference to the attached Figures in which:

Figure 1 shows a schematic view of a HNB product according to the invention which includes a cooling element according to an embodiment of the invention;

Figure 2 shows a schematic view of the cooling element of the invention shown in Figure 1;

Figure 3 shows the cross sectional profile of a number of cooling elements according to various em-

bodiments of the present invention wherein the cross sections of the bores are a variety of different shapes; Figure 4 is a graphical representation of how the temperature at the mouth end of a HNB product varies as puffs are taken when the HNB product contains cooling element A in comparison with when the HNB product contains cooling element B;

Figure 5 is a graphical representation of how the temperature at the mouth end of a HNB product varies as puffs are taken when the HNB product contains cooling element A in comparison with when the HNB product contains cooling element C;

Figure 6 is a graphical representation of how the temperature at the mouth end of a HNB product varies as puffs are taken when the HNB product contains cooling element A in comparison with when the HNB product contains cooling element D.

[0050] Figure 1 illustrates a schematic view of a cylindrical HNB product 100. The HNB product 100 comprises four segments: a cylindrical plug 102 of reconstituted tobacco; a cylindrical plug 104 of cellulose acetate tow; a cylindrical cooling element 106 according to an embodiment of the present invention; and a mouthpiece segment 108 in the form of a cylindrical plug of cellulose acetate tow. Plug 102 of reconstituted tobacco is 8mm long and has a circumference of 22 mm, and forms one end of the HNB product 100. This is the end inserted in a HNB device. Such plugs of reconstituted tobacco are well known in the art. This plug is heated in use by a heating device (HNB device) to produce a vapour as is well known in the art. The plug 102 of reconstituted tobacco is abutted at one end to a 18 mm long cylindrical plug of cellulose acetate tow 104 which is also of circumference 22 mm. The end of the plug of cellulose acetate tow 104 opposite to the plug of reconstituted tobacco 102 is abutted to a cylindrical cooling element 106 according to an embodiment of the present invention.

[0051] Figure 2 shows the cooling element 106 which comprises a longitudinally extending core 110 of thermoformed cellulose acetate material of length 18 mm and circumference 22 mm. The longitudinally extending core 110 includes three longitudinally extending bores 112, all of which have a circular cross section. Each longitudinally extending bore 112 has a diameter of around 2 mm. The longitudinally extending bores 112 extend through the full length of the longitudinally extending core 110 from the end abutting the cylindrical plug 104 to the end abutting the mouthpiece segment 108. As can be seen from Figures 1 and 2, the longitudinally extending bores 112 are arranged in a substantially triangular arrangement in the longitudinally extending core 110. The cooling element 106 has a uniform axial cross section. The manufacture of the cooling element 106 is discussed below.

[0052] Mouthpiece segment 108 is of length 7 mm and circumference 22 mm and comprises a cylindrical plug of cellulose acetate tow. Segment 108 is abutted to the

opposite end of the cooling element 106 to the cylindrical plug of cellulose acetate tow 104 such that cooling element 106 is positioned in between mouthpiece segment 108 and plug 104.

[0053] The cylindrical plug of reconstituted tobacco 102, cylindrical plug of cellulose acetate tow 104, cylindrical cooling element 106 and the mouthpiece segment in the form of a cylindrical plug of cellulose acetate tow 108 are further wrapped with a plugwrap (not shown) of conventional plugwrap paper (that is known in the art). This provides an external appearance similar to that of a conventional cigarette.

[0054] During use, the cylindrical plug of reconstituted tobacco 102 of the HNB product 100 is inserted into a HNB device. The HNB device heats the reconstituted tobacco in the manner conventional for HNB devices. This produces a hot vapour which is first drawn through the plug of cellulose acetate tow 104 and then through the cooling element 106 and then finally through the mouthpiece segment 108 to the smoker's mouth. It is believed that drawing this hot vapour through the 3 bores in the cooling element 106 cools the vapour down to a temperature that is acceptable for the user. The applicants have found that the use of 3 bores in a triangular arrangement provide a particularly effective level of cooling. Further, such a cooling effect is not generally expected from cellulose acetate material.

[0055] The thermoformed cellulose acetate cooling element 106 is produced by a method according to the present invention. A continuous bundle of cellulose acetate filamentary tow containing triacetin plasticiser (the percentage of plasticiser present by total weight of filamentary tow and triacetin plasticiser is around 18%) is pulled through a fix die. While being pulled through the fix die the cellulose acetate material is heat treated to form a longitudinally extending core of thermoformed cellulose acetate material. The fix die includes an inner rod (mandrel) that extend through the fixed die. The mandrel consists of three pins of circular cross section and diameter 2 mm. As the cellulose acetate material is pulled through the die, it passes around the pins of the mandrel such that on exiting the die, a cooling element 106 is formed having three bores 112 of diameter 2 mm extending longitudinally through the core of thermoformed cellulose acetate material 110. Superheated steam is applied to the cellulose acetate while it is in the die via a duct in the die. The heated steam cures the triacetin plasticiser, allowing the cooling element 106 to maintain its shape after exiting the die. The cellulose acetate cooling element 106 is exposed to cooling air at temperature 22 to 25 °C after it is formed for an extended period of time (13 seconds).

[0056] It will be appreciated that by adjusting the shape and size of the pins, the shape and size of the bores can be adjusted. Figure 3 illustrates examples of the possible shapes of bores that can be produced by this method of manufacture.

Experiment

[0057] Cooling element A of the invention was made according to the method of the present invention. Cooling element A comprises a longitudinally extending core of thermoformed cellulose acetate material of length 18 mm and circumference 22 mm. The longitudinally extending core includes four longitudinally extending bores, all of which have a circular cross section. Each longitudinally extending bore has a diameter of between 1.5 mm and 1.6 mm. The longitudinally extending bores extend through the full length of the longitudinally extending core.

[0058] Cooling element A was tested against three conventional tubular cooling elements of differing materials that contain a single bore (B, C and D). The cooling elements were tested in three different conventional HNB products (e.g. heatsticks) with each HNB product including one of the conventional cooling elements B, C or D. Cooling element B was a paper tube, cooling element C was an acetate tube and cooling element D was a hollow PLA rope.

[0059] Each HNB product was inserted into a heating device. The mouth end of the HNB product was inserted into a smoking machine which is configured to smoke the HNB product. An IR camera was used to analyse the temperature at the mouth end of the HNB product while it is being smoked. The smoking machine was configured to take a puff on the HNB product every 30 seconds, each puff being 2 seconds long. The temperature at the mouth end of the HNB product was measured for each puff. The experiment was performed at standard room temperature and humidity. The experiment was repeated for each HNB product. The conventional cooling elements (B, C and D) were then removed from the HNB products and replaced with cooling element A according to the present invention. The experiment was repeated for each of the three HNB products (now containing cooling element A).

[0060] Figures 4, 5 and 6 illustrate the temperature at the mouth end for each puff for the HNB products containing cooling element A in comparison with cooling elements B, C and D. The Figures show that cooling element A of the present invention is capable of providing a cooling effect that is comparable or better than the conventional cooling elements while providing an number of additional benefits e.g. being cheaper to manufacture, providing better sensory characteristics such as taste and feel etc. In particular Figure 6 illustrates that the mouth end temperature of the HNB product with cooling element A is significantly lower than the mouth end temperature with PLA cooling element D for each puff. This indicates the thermoformed cellulose acetate cooling element of the invention can provide improved cooling to conventional PLA elements without the numerous drawbacks of PLA elements.

[0061] There have been disclosed herein the cooling elements, smoking articles, uses and methods defined

by the following numbered paragraphs:

1.) A cooling element comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter $\geq$ 0.8 mm.

2.) A cooling element according to paragraph 1 wherein each bore has a diameter from 0.8 mm to 2.5 mm.

3.) A cooling element according to paragraphs 1 or 2 wherein each bore has a diameter from 1.5 mm to 2.5 mm.

4.) A cooling element according to any preceding paragraph including from 2 to 12 bores.

5.) A cooling element according to any preceding paragraph including from 2 to 6 bores.

6.) A cooling element according to any preceding paragraph including 2, 3, 4, 5, or 6 bores.

7.) A cooling element according to any preceding paragraph wherein each bore extends the full length of the core.

8.) A cooling element according to any preceding paragraph wherein the length of the cooling element is from 5 to 50 mm, e.g. 10 to 30mm, e.g. 8 to 24 mm, e.g. 15 to 20mm, e.g. 18 mm .

9.) A cooling element according to any preceding paragraph wherein the circumference of the cooling element is from 12 mm to 30 mm, e.g. 15 mm to 28 mm, more preferably 17 mm to 25 mm.

10.) A cooling element according to any preceding paragraph wherein the cooling element is thermoformed from cellulose acetate.

11.) A cooling element according to any preceding paragraph wherein each bore has a substantially circular cross section.

12.) A cooling element according to any preceding paragraph wherein a bore has a substantially circular cross section and/or wherein a bore has a cross section of a different shape e.g. semi-circular (D-shaped) cross section, e.g. square cross section, e.g. triangular cross section, e.g. hollow star shaped cross section, e.g. trilobal cross section, e.g. pentagonal cross section, e.g. cog-shaped cross section, e.g. a cross section in the shape of a logo or other pattern.

13.) A cooling element for a tobacco heating product

and/or HNB product comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

14.) A cooling element for a tobacco heating product and/or HNB product comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

15.) A smoking article (e.g. tobacco heating product, HNB product) comprising a cooling element according to any preceding paragraph and optionally one or more discrete further segments.

16.) A tobacco heating product and/or HNB product comprising a cooling element comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

17.) A tobacco heating product and/or a HNB product comprising a cooling element comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

18.) A tobacco heating product and/or a HNB product according to paragraph 16 or 17 wherein each bore has a diameter from 0.8 mm to 2.5 mm.

19.) A tobacco heating product and/or HNB product according to any of paragraphs 16 to 18 including from 2 to 6 bores.

20.) A tobacco heating product and/or HNB product according to any of paragraphs 16 to 19 wherein each bore extends the length of the cooling element.

21.) A tobacco heating product and/or HNB product according to any of paragraphs 16 to 20 further comprising one or more discrete further segments.

22.) The use, in a tobacco heated product and/or HNB product, of a cooling element comprising a longitudinally extending core including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

23.) The use, in a tobacco heated product and/or HNB product, of a cooling element comprising a longitudinally extending core including from 2 to 12 longitudinally extending bores.

24.) A cooling element comprising a longitudinally extending core including 3 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

25.) A cooling element comprising a longitudinally

extending core including 4 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

26.) A cooling element comprising a longitudinally extending core including 5 longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm.

27.) A method of making a cooling element comprising a step of passing a material to which plasticiser has been applied through a shaping means while heat treating the material to thereby form a longitudinally extending core of the material including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm, the shaping means including at least one protruding inner rod (mandrel) comprising a plurality of pins that each have a cross sectional profile substantially equal to the cross section of a longitudinally extending bore.

28.) A cooling element for a tobacco heated product and/or HNB product comprising a longitudinally extending core including 3 longitudinally extending bores.

29.) A cooling element according to paragraph 28 wherein the longitudinally extending bores are arranged in a substantially triangular arrangement.

30.) A cooling element according paragraphs 28 or 29 wherein each bore has a diameter ≥ 0.8 mm.

Claims

1. A cooling element for a tobacco heated product and/or HNB product comprising a longitudinally extending core including 3 longitudinally extending bores.
2. A cooling element according to claim 1 wherein the longitudinally extending bores are arranged in a substantially triangular arrangement.
3. A cooling element according claims 1 or 2 wherein each bore has a diameter ≥ 0.8 mm.
4. A cooling element according to any preceding claim wherein each bore has a diameter from 1.5 to 2.5 mm.
5. A cooling element according to any preceding claim wherein the cooling element is thermoformed from cellulose acetate.
6. A cooling element according to any preceding claim wherein each bore has a substantially circular cross section.

7. A tobacco heating product and/or a HNB product comprising a cooling element comprising a longitudinally extending core including from 3 to 5 longitudinally extending bores. 5
8. A tobacco heating product and/or HNB product accordingly to claim 7 wherein each bore has a diameter ≥ 0.8 mm. 10
9. A tobacco heating product and/or a HNB product accordingly to claims 7 or 8 wherein each bore has a diameter from 0.8 mm to 2.5 mm. 15
10. A tobacco heating product and/or HNB product accordingly to any of claims 7 to 9 including 3 longitudinally extending bores. 20
11. A tobacco heating product and/or HNB product accordingly to any of claims 7 to 10 wherein each bore extends the length of the cooling element. 25
12. A tobacco heating product and/or HNB product accordingly to any of claims 7 to 11 further comprising one or more discrete further segments. 30
13. The use, in a tobacco heated product and/or HNB product, of a cooling element comprising a longitudinally extending core including from 3 to 5 longitudinally extending bores. 35
14. A method of making a cooling element comprising a step of passing a material to which plasticiser has been applied through a shaping means while heat treating the material to thereby form a longitudinally extending core of the material including a plurality of longitudinally extending bores wherein each bore has a diameter ≥ 0.8 mm, the shaping means including at least one protruding inner rod (mandrel) comprising a plurality of pins that each have a cross sectional profile substantially equal to the cross section of a longitudinally extending bore. 40

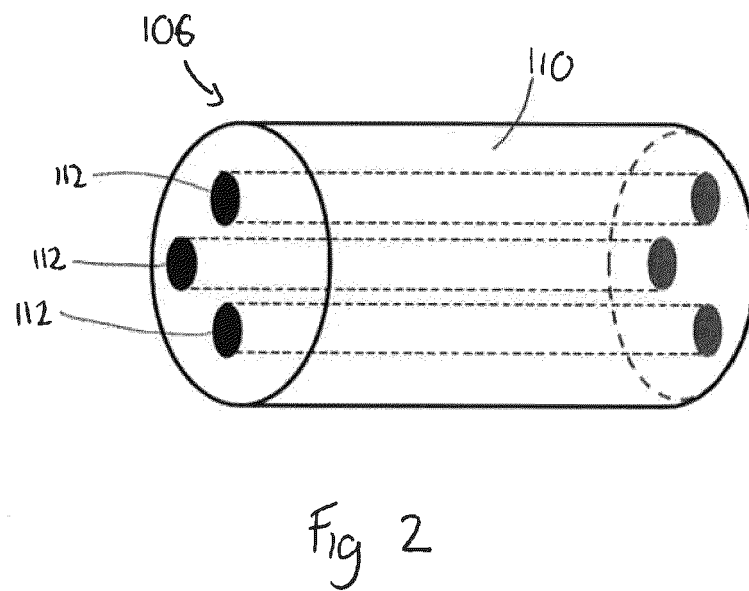
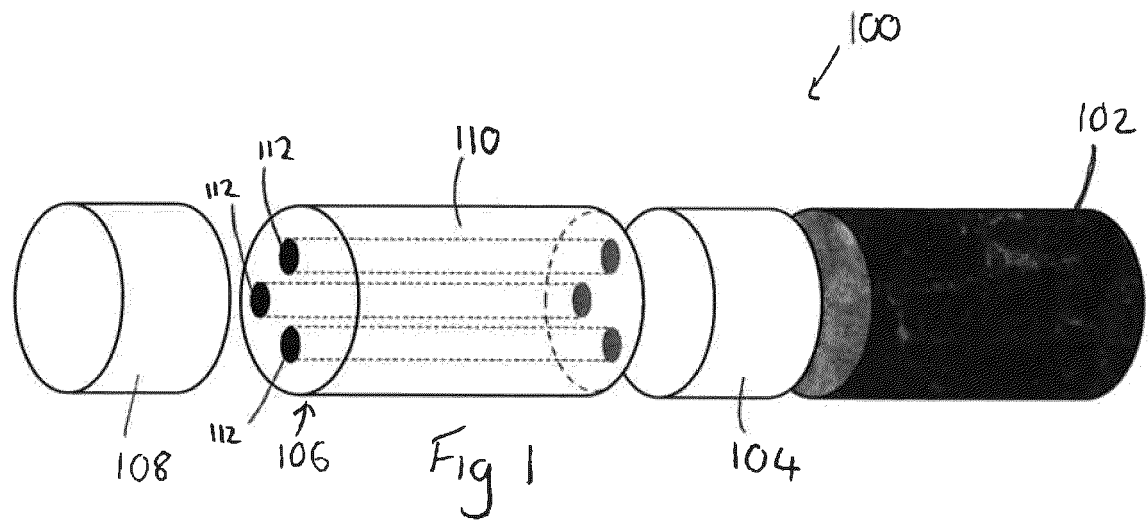
wherein each bore extends the length of the cooling element.

4. A HNB product according to any preceding claim further comprising one or more discrete further segments.

5. The use, in a HNB product, of a cooling element comprising a longitudinally extending core including 3 longitudinally extending bores, the longitudinally extending core being of uniform axial cross section, wherein each bore has a diameter ≥ 0.8 mm, and wherein cooling element comprises thermoformed cellulose acetate and a plasticiser.

Amended claims in accordance with Rule 137(2) EPC.

1. A HNB product comprising a cooling element comprising a longitudinally extending core including 3 longitudinally extending bores, the longitudinally extending core being of uniform axial cross section, wherein each bore has a diameter ≥ 0.8 mm, and wherein the cooling element comprises thermoformed cellulose acetate and a plasticiser. 45
2. A HNB product according to claim 1 wherein each bore has a diameter from 0.8 mm to 2.5 mm. 50
3. A HNB product according to any preceding claim 55



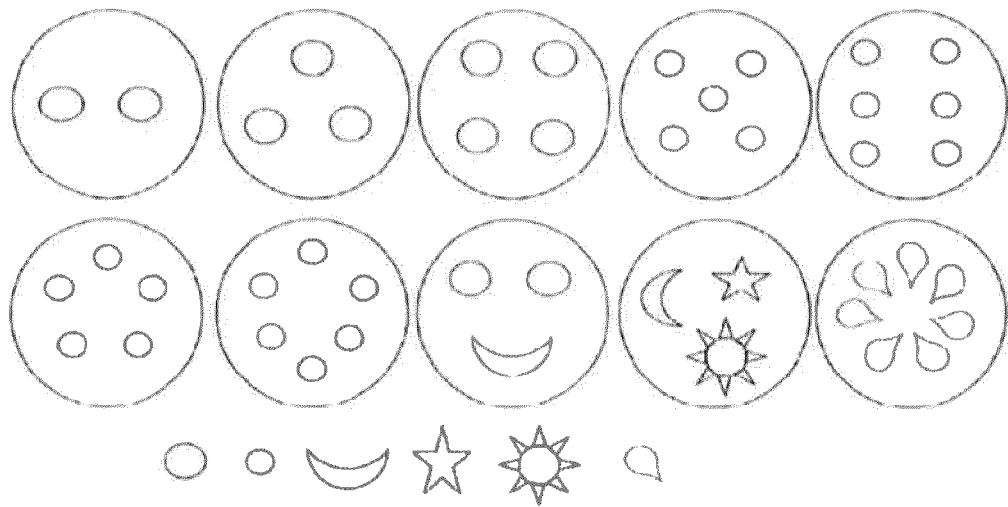


Fig 3

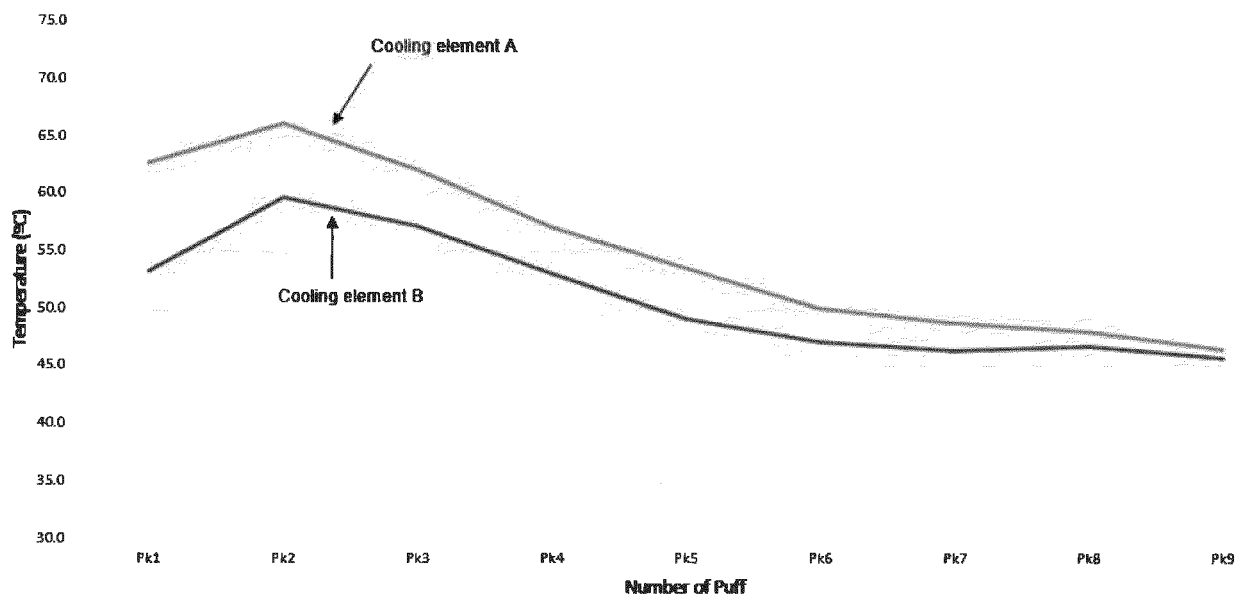


Figure 4

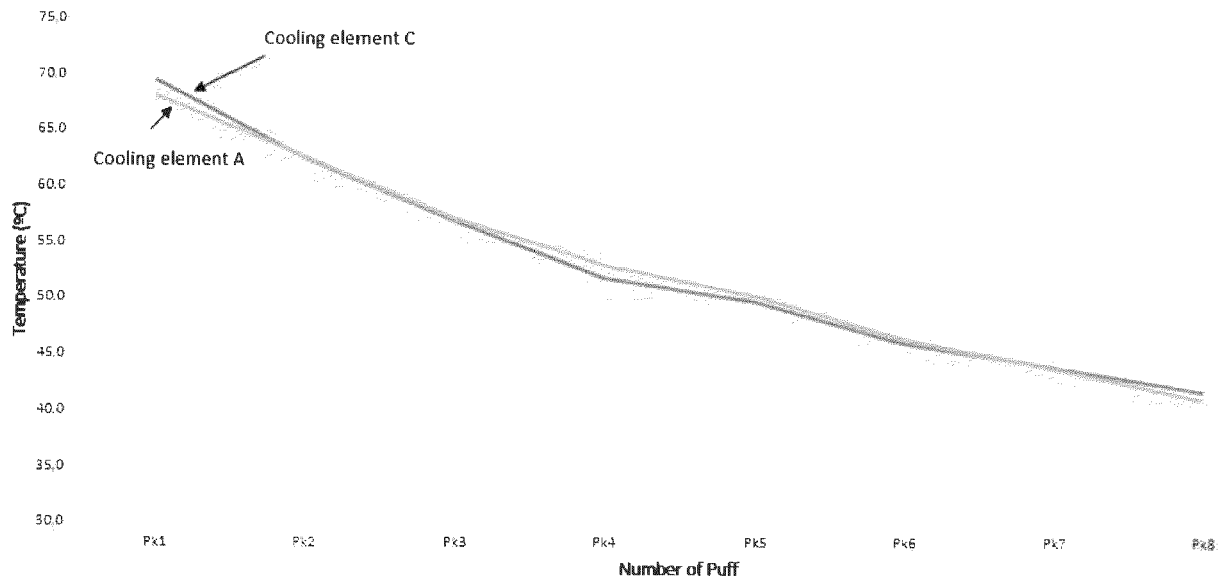


Figure 5

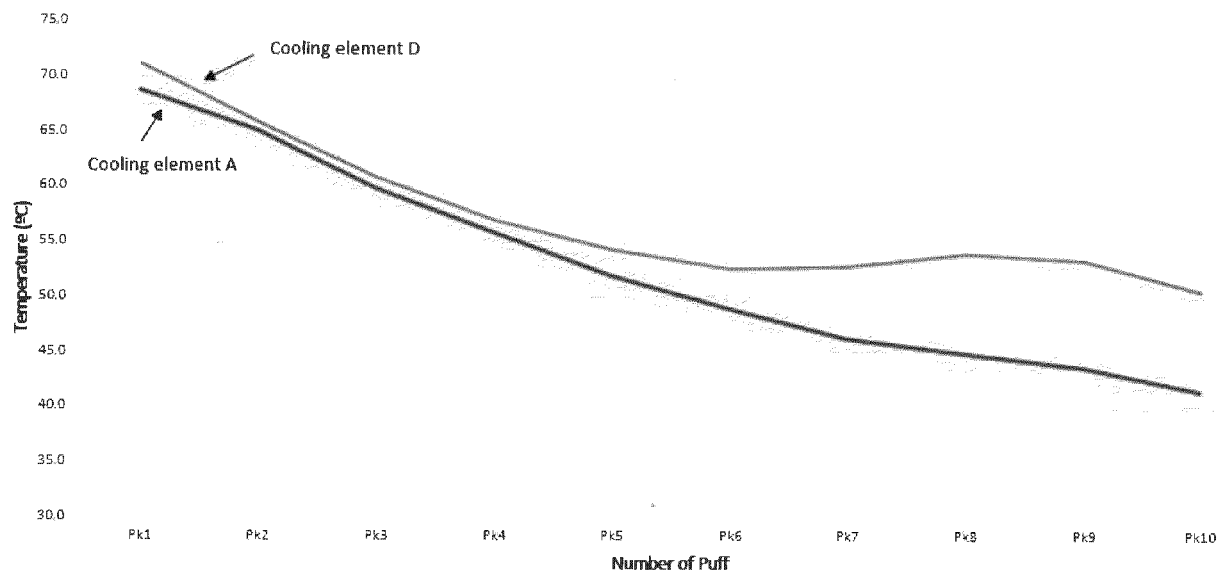


Figure 6



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