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(54) **Smoking article with novel wrapper**

(57) A smoking article (20) comprises a tobacco rod (22) and a wrapper paper having a base web with a nominal permeability, and regions (31 a,b) extending along the tobacco rod. Each region has two zones (34a,b, 36a, b) of add-on material circumferentially spaced around the tobacco rod with a permeability less than the nominal permeability. The two zones are substantially opposed to one another. Each zone in a region is laterally offset from a respective zone of adjacent regions by about 10% to about 35% of the total, unwrapped cross-measure of the base web each region is longitudinally spaced apart from adjacent regions. When a smoking article is placed

on a substrate, at least two longitudinal locations along the length of the tobacco rod have add-on material located only on sides of the smoking article not in contact with the substrate. At these longitudinal locations, the restricted airflow to the tobacco due to the presence of the substrate, in combination with the add-on material at the sides is sufficient to cause the smoking article to self-extinguish. However, when the smoking article is held by a smoker, the presence of the add-on material does not by itself cause the smoking article to extinguish. A desirable self extinguishment performance is therefore maintained.

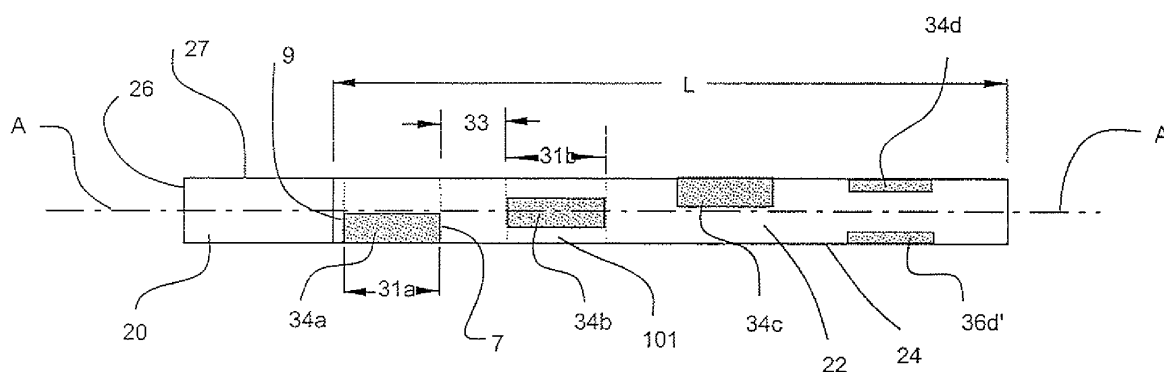


FIG. 1

Description

FIELD OF THE DISCLOSURE

[0001] This disclosure relates generally to a smoking article and, more particularly, a smoking article having a pattern provided on the wrapping paper for reducing ignition propensity of the burning smoking article when left unattended upon a substrate.

SUMMARY

[0002] A smoking article includes a tobacco rod with a wrapper paper formed from a base web having a nominal permeability. Zones of add-on material are preferably applied to the base web according to a pattern that includes a plurality of circumferentially spaced regions that are longitudinally spaced along the tobacco rod. Each of the regions preferably includes at least two substantially opposed zones of add-on material, which zones exhibit a permeability less than the nominal permeability. The zones of add-on material preferably have sufficient size, shape, and add-on material concentration that, when the tobacco rod is smoldering and is placed on a substrate, that the tobacco rod will tend to extinguish at the corresponding region. For each first, second, and third consecutive region, the zones of the second region are circumferentially offset from the zones of the first region. Moreover, the zones of the third region are circumferentially offset from the zones of both the first and second regions.

[0003] The pattern preferably continues substantially along the tobacco rod so that, when the tobacco rod is placed on a substrate and viewed from an end, at least one region will be situated such that its zones of add-on material are positioned substantially at side portions of the tobacco rod.

[0004] The smoking article preferably exhibits an Ignition Propensity no greater than about 25% and a self-extinguishment value no greater than about 50%.

[0005] A smoking article according to this disclosure preferably includes a wrapper paper having a pattern formed by a permeability reducing film-forming compound. The pattern is selected so that when the smoking article is placed on a substrate, the smoking article will self-extinguish when an advancing burn line reaches one or more longitudinal locations where film-forming compound is present at sides of the smoking article not in contact with a substrate but those sides having film-forming compound or agent will not cause the smoking article to self-extinguish when the smoking article is held by a smoker. Hence, a pattern may be selected that takes into account the obstructed airflow through the side or side portion of the smoking article that contacts a substrate. By doing so, a smoking article may have both a reduced ignition propensity and satisfactory free-burn quality.

[0006] The smoking article may have a circular or near circular cross section, implying that any side or side por-

tion of the smoking article may be placed against a substrate, such as when the smoking article is dropped on a surface or when the smoking article is left unattended. In this respect, the patterns described herein define sides or side portions having film-forming compound not in contact with the substrate, regardless of the smoking article orientation when it happens to be in contact with the substrate. The smoking article may also have a non-circular cross-section.

[0007] The wrapping paper and its zones of add-on material may include a plurality of discrete shapes, each of which extends over less than the length of the tobacco rod. At each of a plurality of spaced-apart longitudinal locations along the tobacco rod, only a first and second shape of the pattern is present in a cross section taken substantially perpendicular to the longitudinal axis of the tobacco rod. At one such location, the first shape is disposed only on a first side of the smoking article and the second shape is disposed only on a second side opposite the first side of the smoking article. The first and second shapes may be spaced apart by substantially 180° and have a porosity substantially less than the porosity of the base web. If desired, the plurality of discrete shapes may be arranged so that a cross-sectional plane through the tobacco rod intersects at least two such discrete shapes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Many objects and advantages of the present disclosure will be apparent to those skilled in the art when this specification is read in conjunction with the accompanying drawings, wherein like reference numerals are applied to like elements and wherein:

FIG. 1 is a perspective view of a smoking article in accordance with a first embodiment of the invention. FIG. 2 is an enlarged plan view of an unwrapped portion of wrapping paper used in the construction of the smoking article of FIG. 1.

FIG. 3 is an enlarged plan view of a wrapping paper for the smoking article illustrating a second quadrilateral pattern.

FIG. 4 is an enlarged plan view of a wrapping paper for the smoking article, illustrating a third quadrilateral pattern.

FIG. 5 is an enlarged plan view of a wrapping paper for the smoking article, illustrating a fourth quadrilateral pattern.

FIG. 6 is an enlarged plan view of a wrapping paper for the smoking article, illustrating a triangular pattern.

FIG. 7 is a side view of the smoking article using the wrapper paper of FIG. 3 with the smoking article on a substrate and oriented so that a first side portion of the smoking article contacts a substrate.

FIG. 8 is a side view of the smoking using the wrapper paper of FIG. 3 with the smoking article on a substrate and oriented so that a second side portion of

the smoking article contacts the substrate.

FIG. 9 is a side view of the smoking article using the wrapper paper of FIG. 3 with the smoking article on the substrate and oriented so that a third side portion of the smoking article contacts the substrate.

FIG. 10 is a cross-sectional view of the smoking article taken along line 10-10 of FIG. 7.

FIG. 11 is a cross-sectional view of the smoking article taken along line 11-11 of FIG. 7.

FIG. 12 is a cross-sectional view of the smoking article taken along line 12-12 of FIG. 7.

FIG. 13 is an enlarged cross-sectional view of the smoking article positioned on a substrate and illustrating airflow to a smoldering coal.

FIG. 14 is an enlarged cross-sectional view of the smoking article removed from the substrate and illustrating airflow to a smoldering coal.

DETAILED DESCRIPTION

[0009] In accordance with this description, a first embodiment of a smoking article 20 (see FIG. 1) includes a tobacco rod 22. The tobacco rod 22 may include a cut filler of tobacco and is surrounded by wrapper paper 24. One end of the smoking article 20 may include a suitable filter 26 surrounded by suitable filter tipping paper 27. The smoking article 20 typically may have a generally circular cross section over the length of the smoking article. Nevertheless, other cross-sectional shapes including, for example, oval, are within the scope of this description. The tobacco rod 22 has a nominal length L measured from an edge of the tipping paper 27 to the free end of the tobacco rod 22 along a longitudinal axis A of smoking article 20. By way of example, that nominal length may lie in the range of about 60mm to about 100mm.

[0010] The wrapper paper 24 includes a base web which typically is permeable to air. Permeability of wrapper paper is typically identified in Coresta units. A Coresta unit measures paper permeability in terms of volumetric flow rate (i.e., cm³/sec) per unit area (i.e., cm²) per unit pressure drop (i.e., cm of water). The base web of conventional wrapper paper also has well-known basis weights, measured in grams per square meter, abbreviated as "gsm". The permeability and basis weight for the base web of typical smoking article papers commonly used in the industry are set out in the table below:

Permeability, Coresta units	Basis Weight, gsm
24	25
33	25
46	25
60	26

[0011] For purposes of this description, the base web 24 of a preferred wrapper paper has a permeability of at least about 20 Coresta units. Most preferably, the wrap-

ping paper has a permeability greater than about 30 Coresta, such as common base webs having nominal permeabilities of about 33 and about 46 Coresta with a basis weight of about 25 gsm. For some applications, the base web may have a permeability of greater than about 60 Coresta, or greater than about 80 Coresta, or even higher permeability values.

[0012] With reference also to FIG. 2, the paper wrapper further comprises pairs of add-on material zones at spaced locations along the tobacco rod 22 in FIG. 1 (such as the opposing pair of zones 34d, 36d).

[0013] Each pair of rectangular zones (for example, 34a and 36a--the latter not being visible in FIG. 1) define a circumferential region 31 (for example, the region 31 a). The "width" of the banded region 31 a is measured from a leading edge 7 of the region 31 a (it being closest to an approaching coal) to the trailing edge 9 (it being most remote from an approaching coal). Preferably the width of the regions, e.g., 31 a, lies in the range of about 5.5mm to about 12mm, more preferably, about 7mm to about 10mm, and most preferably about 8mm to about 9mm. Moreover, at each circumferential region, such as region 31 a, the zones 34a and 36a are circumferentially spaced apart such that they are disposed in mutually opposing relation along opposite sides of the wrapper 24 when formed on a tobacco rod 22. Preferably each zone 34a, 36a extends circumferentially (i.e., in cross-measure relative to the paper web) in the range of about 5mm to about 9mm in cross-measure, more preferably, about 6mm to about 7mm in cross-measure.

[0014] It is noted for sake of convention that, in describing dimensions of various embodiments herein, that "width" will extend in a longitudinal direction of the tobacco rod, whereas a dimension in the circumferential direction will be expressed as "transverse" or "cross-direction" or "cross-measure".

[0015] It is further noted that the area 33 of base web between adjacent regions 31 a, 31 b and the areas between opposing zones within each region (such as between the opposing zones 34b, 36b of the region 31 b) are preferably essentially free of add-on material comprising the zones (e.g., zones 34b, 36b).

[0016] The longitudinal distance between adjacent regions (such as between regions 31 a, 31 b) is referenced as band spacing 33, which is preferably about 4mm to about 12mm, and more preferably about 6mm to about 8mm.

[0017] Preferably, the respective opposing zones 34, 36 of each region 31 are offset from those of a preceding row or region to a degree (in accordance with teachings which follow) and a sufficient number of regions 31 are established along a given tobacco rod (per selection of band-region width and width of band-region spacing) that, when the smoking article is placed up on a substrate, that there occurs at least one location 101 along the tobacco rod 22 where the respective pair of zones 34 are oriented substantially alongside the tobacco rod 22, such as the opposing pair of zones 34b, 36b in FIG. 1. It is at

or about this portion (location 101) of the tobacco rod 22 where self-extinguishment is most likely to occur. The location along the tobacco rod 22 where this orientation most closely occurs is hereinafter referenced as the "oriented snuffer region 101."

[0018] Because the smoking article 26 might be laid upon a substrate differently from that shown in FIG. 1 and/or because its pattern of zones may differ, it is to be realized that the oriented snuffer region 101 may appear at different longitudinal positions along the tobacco rod 22 for different rotational positions of the tobacco rod 22. The pattern of zones and the band spacing 33 may be selected such that more than one oriented snuffer region 101 may occur along the tobacco rod 22.

[0019] Preferably, each zone 34, 36 and 36' includes sufficient add-on material to reduce the permeability of the wrapper at each zone to 0.0 to about 10 CORESTA, more preferably about 7 Coresta or less.

[0020] For purposes of this description, a pattern of add-on material is applied to the wrapper paper 24 to obtain improved ignition propensity characteristics and also to obtain improved self-extinguishment characteristics. Ignition propensity is a standard test conducted as set forth in ASTM E 2187--04, "Standard Test Method for Measuring the Ignition Strength of Smoking articles", which is incorporated herein in its entirety by this reference thereto. Ignition propensity measures the probability that a smoking article, when placed on a substrate, will generate sufficient heat to maintain static burning of the tobacco rod 22. Low values for ignition propensity are desirable as such values correlate with a reduced likelihood that a smoldering smoking article will cause combustion in an underlying substrate.

[0021] Self-extinguishment herein is a reference to smoldering characteristics of a smoking article under free-burn conditions. To evaluate self-extinguishment, a laboratory test is conducted at a temperature of $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ and relative humidity of $55\% \pm 5\%$, both of which should be monitored by a recording hygrothermograph. Exhaust hood(s) remove combustion products formed during testing. Prior to testing, smoking articles to be tested are conditioned at $55\% \pm 5\%$ relative humidity and $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 24 hours. Just prior to testing, the smoking articles are placed in glass beakers to assure free air access.

[0022] Self-extinguishment testing takes place within an enclosure or test box. A single port smoking machine or an electric lighter is used to ignite the smoking articles for the test. During testing, an apparatus or "angle holder" holds the smoking articles to be tested by holding an end at angles of 0 degrees (horizontal), 45 degrees, and/or 90 degrees (vertical). Twenty (20) smoking articles are tested at each of the 0 degrees, 45 degrees, and 90 degrees positions. If more than one apparatus is used, the apparatuses are preferably positioned such that the smoking articles face away from each other to avoid cross interference. If a smoking article goes out before the front line of the smoldering coal reaches the tipping paper, the

outcome is scored as "self-extinguishment"; on the other hand, if the smoking article continues smoldering until the front line of the smoldering coal reaches the tipping paper, then the outcome is scored as "non-extinguishment". Thus, for example, a self-extinguishment value of 95% indicates that 95% of the smoking articles tested exhibited self-extinguishment under free-burn conditions; while a self-extinguishment value of 20% indicates that only 20% of the smoking articles tested exhibited self-extinguishment under free-burn conditions.

[0023] The self-extinguishment value may be referred to in terms of "self-extinguishment at 0 degrees value", "self-extinguishment at 45 degrees value", or "self-extinguishment at 90 degrees value", each of which refers to the value of self-extinguishment at the specified tested angle. In addition, the self-extinguishment value may be referred to in terms of "self-extinguishment Average value", which refers to an average of the three angular positions: namely, an average of (i) the "self-extinguishment at 0 degrees value", (ii) the "self-extinguishment at 45 degrees value", and (iii) the "self-extinguishment at 90 degrees value". A reference to "self-extinguishment value" or does not distinguish between self-extinguishment at 0 degrees, self-extinguishment at 45 degrees, self-extinguishment at 90 degrees, or self-extinguishment average values and may refer to any one of them.

[0024] The phrases "self-extinguish under free-burn conditions" or "self-extinguishment under free-burn conditions" as used herein, refer to the extinguishment of a smoldering cigarette without puffing, when such cigarette is subjected or exposed to free-burn conditions.

[0025] As presently understood, the staggered zones of add-on material according to this description permit a smoking article 20 (see FIG. 1) to be designed with an advantageous combination of low ignition propensity values and low self-extinguishment values. The patterns of low permeability zones of add-on material provide areas of film-forming compound along the length of the tobacco rod 22 that can cooperate with a substrate to extinguish the lit smoking article 20 when it is placed on that substrate, yet these areas of add-on material (such as a film-forming compound) cause the smoking article 20 to self-extinguish at statistically fewer occurrences when the smoking article 20 is held by a smoker in a free-burn condition. Thus, the smoking article 20 can exhibit a reduced ignition proclivity while retaining a desirable free-burn quality or low self-extinguishment value by applying a pattern 30 of film-forming compound to the base web according to this description.

[0026] To achieve desirable ignition propensity and self-extinguishment characteristics of the smoking article, a pattern 30 (see FIG. 2) is applied to the base web 24 of the wrapper paper, preferably while the base web 24 is in an unfolded condition, such as shown in FIG. 2, or when the base web comprises a roll of cigarette paper that has yet to be slit into bobbins. An object of this description is to provide wrapper papers which, when formed into a tobacco rod 22, exhibit IP values no greater

than 25 and self-extinguishment values no greater than 50. Even more preferred, is an IP value for the resulting smoking article no greater than about 15; and the most preferred IP value for the resulting smoking article is no greater than about 10. Lower self-extinguishment values are also desired. In this connection, a more preferred self-extinguishment value is less than about 25; while the most preferred self-extinguishment value is less than about 10.

[0027] Referring specifically to FIG. 2, the transverse dimensions of the wrapper paper 24 are selected based on the diameter of the finished smoking article (about 7mm to about 10mm) and allowing for overlapping material at a longitudinal seam of about 1mm to about 2 mm. For example, allowing for 1 mm overlapping seams, the wrapper-paper cross-web dimension may be about 27mm for a smoking article having a circumference of about 25.6mm.

[0028] Preferably, the pattern is applied to the base web such that a plurality of circumferentially extending regions 31 a, 31 b, 31 c, 31 d (defined by broken lines in FIG. 2) are disposed at spaced locations along the tobacco rod 22 (see arrow B, in FIG. 2). The add-on material can be applied to one or to both sides of the base web. Preferably, three to six, and most preferably four to six or more, of the regions 31 occur in the nominal length of the tobacco rod 22. Each of the circumferential regions 31 a, 31 b, 31 c, 31 d has a longitudinal pitch along the tobacco rod 22 (i.e., length measured along the tobacco rod from the beginning of one region to the beginning of the adjacent region) which is less than the nominal length of the tobacco rod 22. By selecting the longitudinal pitch length at about 25% of the nominal length, four regions will be provided on each tobacco rod 22.

[0029] Within each circumferential region, e.g., 31a, at least two zones, e.g., 34a, 36a, of add-on material are provided. Note that the zones of add-on material in all of the Figures are identified with stippling to aid identification of them; however, in a smoking article or wrapper paper for such a smoking article, these zones of add-on material may, or may not, be visually identifiable. Each of these zones is preferably spaced circumferentially such that the zones will be opposed to one another in the finished tobacco rod 22. Moreover, for each triplet of zones, e.g., 31a, 31b, 31c, the zones 34b, 36b of the second region 31b preferably are circumferentially offset from the zones 34a, 36a of the first region. Furthermore, the zones 34c, 36c of the third region 31 c preferably are circumferentially offset from the zones 34b, 36b of the second region 31 b, and even further offset circumferentially from the zones 34a, 36a of the first region 31 a.

[0030] As depicted in FIG. 2, the add-on zones of each region in this embodiment are laterally offset in a circumferential direction from the add-on zones of an adjacent region by a distance that is a function of the transverse dimension of the add-on zones. Each zone has a width measured along the tobacco rod 22 and a transverse cross-measure dimension in the circumferential sense

of direction of the tobacco rod 22. For this embodiment, the zone width is less than the longitudinal pitch of the associated region. As seen in FIG. 2, the longitudinal pitch length may be greater than the corresponding zone width of the corresponding region. The add-on zones of successive regions along the tobacco rod 22 are preferably offset from the add-on zones of the adjacent regions, thereby defining a pattern 30 of regions which cover portions of the base web along lines inclined relative to the edge of the base web. Furthermore, the pattern of add-on zones may repeat itself at least partially along the length of the base web.

[0031] In the illustrated embodiment (FIG. 2), each zone is placed on the wrapper paper 24 so that the zone is centered upon one of three paths 34, 36, and 38, which paths are represented by corresponding broken lines 34, 36 and 38. Thus, for example, path 34 passes through the corresponding geometric features of six zones 34a, 34b, 34c, 34d, 34e, 34f. Each zone is spaced from the other zones, but the zones could, alternatively, contact one another. The paths 34, 36 and 38 are parallel to each other and oriented at an acute angle Φ relative to the side edge of the wrapper paper 24. It is to be realized that zones 36' are preferably the same as zones 36 and result from progression through the pattern shown in FIG. 2 where, as zones 34 disappear along one edge, zones 34' appear along the opposite edge. Each pair of cross-web aligned zones, e.g., zones 34a, 36a, or zones 34b, 36b, may cover up to about 33% of the total surface area of the corresponding region 31 a, 31 b. For rectangular zones, each zone is preferably in the range of about 8mm to about 10mm in the longitudinal direction or width, and about 5mm to about 7mm in the circumferential cross-measure direction. Longitudinal spacing 33 between the zones preferably lies in the range of 4mm to about 12mm, and more preferably in the range of about 6 to about 8 mm. The circumferential spacing of the zones of add-on material is preferably in the range of about 3mm to about 20mm, more preferably in the range of about 5mm to about 8mm, and most preferably in the range of about 5.5mm to about 7.0mm.

[0032] When wrapper paper 24 is formed about tobacco to make a tobacco rod 22, zones of add-on material at any longitudinal location are preferably spaced about 180 degrees from each other. Moreover, the ratio of the area occupied by zones of add-on material to the total area, the total area being the sum of (i) the corresponding region 31 d and (ii) the annular area between adjacent regions on one side (that ratio here being defined as the "zone area ratio") is substantially less than one. Preferably, that zone area ratio lies in the range of less than about 20% to less than about 50%, and more preferably in the range of less than about 20% to less than about 35%. More particularly, in some embodiments the zone area ratio for zone-occupied area to total area may be less than 30%, and even less than 25%. Generally speaking, it is desirable to keep the zone area coverage ratio low because high values (i.e., closer to 1) are believed

to increase carbon monoxide concentration in mainstream smoke where low permeability (i.e., low Coresta) wrapper paper is used for the tobacco rod.

[0033] When the wrapper paper 24 is formed to make the tobacco rod 22, the paths 34, 36, 36' describe a first helical path 36/36' (zones 36 and 36' in FIG. 2 combine to form a helical path 36/36') and a second helical path 34 (comprising helically aligned zones 34) both of which extend lengthwise, around axis A, and over the length of the tobacco rod 22, as illustrated in FIGS. 7-9. The helical paths 36/36' and 34 (as seen from FIG. 2) have a helix angle Φ and do not intersect one another. Preferably, both helical paths may follow one of a counterclockwise and clockwise rotation about the tobacco rod 22. As illustrated, both paths 34, 36' follow a clockwise path, starting at the filter end of the tobacco rod 22, when viewed from the lit end and looking towards the filter end.

[0034] The zones of the pattern 30 may be formed by applying one or more layers of an aqueous film-forming composition to the base web of the wrapper paper to reduce the permeability of the paper in those zones. Alternatively, a cellulosic material may also be used to form the zones. Where a film-forming composition is used, that film-forming composition preferably may include water and a high concentration of an occluding agent, e.g., 20% to about 50% by weight. The film-forming compound can include one or more occluding agents such as starch, alginate, cellulose or gum and may also include calcium carbonate as a filler. Where starch is the film-forming compound, a concentration of about 24% may be advantageous. The film-forming composition may be applied to the base web of the wrapper paper 24 using gravure printing, digital printing, coating or spraying using a template, or any other suitable technique. For example, the film-forming compounds and methods for applying film-forming compounds described in US patent application number 11/500,918, which is hereby incorporated herein in its entirety by this reference thereto, may be chosen for applying a pattern to the base web of the wrapper paper. If desired, the zones of add-on material can be formed by printing multiple, successive layers, e.g., two or more successive layers registered or aligned with one another. Furthermore, when layers are used to form the zones of add-on material, the material in layers may be the same or different. For example, one layer may be starch while the next layer may be starch and calcium carbonate (or vice versa).

[0035] The presently preferred embodiment for the pattern 30 of zones of add-on material is illustrated in FIG. 3. Like the embodiment of FIG. 2, the zones of add-on material in FIG. 3 are quadrilateral, specifically, generally rectangular. Preferably, at least two zones, e.g., 40a, 40b, of add-on material are applied in each region 31 a, 31 b, 31 c, 31 d so as to be circumferentially spaced in the finished smoking article. The circumferential dimension of each zone 40a, 40b is preferably selected to be less than about 50% of the cross-measure of the base web 24 when unwrapped, and most preferably about

25% of the cross-measure of that base web 24 or of the circumference of the tobacco rod 22. The circumferential dimension of each zone 40a, 40b, when added to the circumferential spacing of between the zones 40a, 40b, preferably is about 50% of the circumferential cross-measure of the base web 24.

[0036] The longitudinal length of the zones 40a, 40b plus the longitudinal spacing 33 between the zones 40a, 40b, and zones 42a, 42b, (i.e., the longitudinal pitch length) is preferably selected so that three or four regions 31 a, 31 b, 31 c, 31 d will occur in the nominal length of the tobacco rod 22 of the smoking article and such that add-on zones of adjacent regions are spaced from one another longitudinally. Preferably, the longitudinal expanse or "width" of the zones, e.g., 40a, 40b (i.e., the zone width or region width as previously defined) lies in the range of about 8mm to about 10mm. The circumferential offset, x, between (i) the zones 42a, 42b of the region 31 b and (ii) the zones 40a, 40b of the region 31 a preferably lies in the range of about 10% to about 35% of the total, unwrapped cross-measure of the base web 24. More preferably, the circumferential offset, x, lies in the range of about 12% to about 35% of the total, unwrapped cross-measure of the base web 24. Most preferably, the circumferential offset, x, is about half the circumferential dimension or cross-measure of the add-on zone 40a, 40b. The zones of add-on material in other regions, 31 c, 31 d, are likewise further offset circumferentially by the same offset, x, with respect to each other. It will be noted that, for example, in region 31 d one of the zones 46a, 46c of add-on material gets split between the two edge portions of the base web 24 when the base web is in an unwrapped condition.

[0037] The pattern applied in regions 31a-31d preferably repeats along the length of the base web 24. Clearly, if the circumferential offset, x, is less than 12.5% of the cross-directional width of the base web, more than four regions will define a complete cycle or phase length for the pattern 30. Conversely, if the circumferential offset, x, is greater than 12.5%, less than four regions will define a complete cycle length for the pattern 30 (as in the case of the FIG. 2 pattern).

[0038] A further embodiment of the pattern 30 (see FIG. 4) uses quadrilateral zones 60a, 60b of add-on material, namely substantially parallelogram-shaped zones. While the zones 60a, 62a are arranged so as to be in general helical alignment with one another when the wrapper paper is formed into a tobacco rod 22, the configuration of the parallelogram shapes 60, 62, 64, 66 may be selected as desired. For example, the mirror images of the shapes (mirrored about the longitudinal direction) could be used, even though the general helical impression might be lost. Likewise, the skewness of the parallelogram zones may be changed as may be desired. Generally, however, the circumferential dimensions, circumferential spacing or offset, longitudinal dimensions, and longitudinal spacing or offset of the zones 60, 62, 64, 66 and the regions 31a-31d in this embodiment may be se-

lected as described in other embodiments.

[0039] Still another embodiment of the pattern 30 (see FIG. 5) uses quadrilateral zones 70, 72, 74, 76 of add-on material, namely substantially trapezoidal zones. Here again, the generally trapezoidal zones 70a, 72a may be arranged so as to be in general helical alignment with one another when the wrapper paper is combined into a tobacco rod 22. In addition, the actual shape of the trapezoidal zones 70, 72, 74, 76 may be selected as desired. For example, the skewness of the trapezoidal zones, and the proportions of the trapezoidal zones may be changed as may be desired. Generally, however, the circumferential dimensions, circumferential spacing or offset, longitudinal dimensions, and longitudinal spacing or offset of the zones 70, 72, 74, 76 and the regions 31a-31d in this embodiment may be selected as described in other embodiments. It is preferred that the leading edge 7 be the longer of the two parallel edges of the zones 70.

[0040] Yet another embodiment of the pattern 30 (see FIG. 6) uses generally triangular zones 80, 82, 84, 86 of add-on material. The generally triangular zones 80a, 80b of region 31 a may be constructed and arranged so as to touch the corresponding generally triangular zones 82a, 82b of the next adjacent region 31 b. If the IP and SE characteristics desired require it, the generally triangular zones 80a, 80b of the first region 31 a may be longitudinally spaced from the triangular zones 82a, 82b of the adjacent region 31 b. Depending on the characteristics required for the smoking article design, it is also contemplated that the generally triangular regions may be oriented so that the burning coal of a smoldering smoking article encounters the triangular apex and gradually increasing cross-directional dimension of the generally triangular zones (i.e., from right-to-left in FIG. 6), or such that the burning coal of a smoldering smoking article encounters the base of the triangular zones and an abrupt increase in the lower permeability zones (i.e., from left-to-right in FIG. 6). Circumferential spacing of the triangular zones 80, 82, 84, 86 and the size of those triangular zones may be determined in accordance with the preferred ranges set out elsewhere in this description. Moreover, the triangular zones may be isosceles triangles as depicted, or equilateral triangles, or right triangles, or any other desired triangular shape that may be desired. Generally, however, the circumferential dimensions, circumferential spacing or offset, longitudinal dimensions, and longitudinal spacing or offset of the zones 80, 82, 84, 86 and the regions 31a-31d in this embodiment may be selected as described in other embodiments. Preferably, the triangular forms of the zones 80 are oriented so that a leading edge 4 (closest to an approaching coal) is established.

[0041] Three different positions of the smoking article 20 resting on substrate 98 are illustrative of the cooperation which occurs between the zones of low permeability add-on material and the substrate 98. One position (see FIG. 7) illustrates a side view of the smoking article 20 according to this description. Rotation of the smoking ar-

ticle through a 45 degree angle about its longitudinal axis (clockwise from the left end of FIG. 7) results in an elevation similar to that shown in FIG. 8. Similarly, further rotation of the smoking article 20 through another 45 degree angle (also clockwise from the left end of FIG. 7) results in an elevation to that illustrated in FIG. 9. In each of FIGs. 7-9 it can be seen that at least one pair of zones of add-on material are positioned on the sides of the smoking article at a location along the length of the tobacco rod 22, e.g., zones 92, 92' of FIG. 7, zones 94, 94' of FIG. 8, and zones 96, 96' of FIG. 9. At those locations where the zones of add-on material are positioned substantially on the sides of the smoking article 20 (FIG. 12), the zones 92, 92' are substantially upright or generally perpendicular to the surface of the substrate 98. That orientation of the zones 92, 92' is best illustrated in FIG. 12, where the opposed zones 92, 92' are located on corresponding opposed sides of the smoking article 20 when viewed in cross section, substantially symmetrically positioned relative to a diameter of the tobacco rod 22, which diameter is substantially parallel to the surface of the substrate 98.

[0042] Orientation of the zones of add-on material at other longitudinal locations along the smoking article 20 are shown in FIGs. 10 and 11. In FIG. 10, the zones 90, 90' of add-on material are positioned such that one zone 90 touches the substrate 98. The zones 94, 94' of the smoking article 20 in FIG. 7 would also be positioned as in FIG. 10, when viewed from the right end of FIG. 7. In FIG. 11, one zone 96' contacts the substrate 98, but the other opposed zone 96 is located at the top of the smoking article 20. From consideration of FIGs. 7-9, it will be appreciated that regardless of the angular position of a smoking article 20 having the pattern of zones of add-on material described, at least one pair of opposed zones of add-on material are positioned as shown in FIG. 10, or FIG. 12, or a rotated position between those positions. This position has been referred to above as the oriented snuffer region 101.

[0043] When the smoking article 20 exists in free-burn condition (see FIG. 14), the zones 92, 92' obstruct airflow to the burning coal of the tobacco rod 22 by virtue of their reduced permeability. On the other hand, the bottom portion 104 of the wrapper paper freely permits air to enter the side of the tobacco rod 22 to support combustion of the coal. A vastly different situation occurs when the smoking article 20 is placed on a substrate 98 (see FIG. 13). Here, the substrate 98 blocks the flow of air upwardly to the bottom portion 90 of the tobacco rod 22. The zones 92, 92' and the substrate 98 cooperate to define much smaller areas 100, 102 through which air can be delivered through the base web. More specifically, the vertical area 100 between the bottom of the zone 92 and the substrate 98 and the vertical area 102 between the bottom of the zone 92' and the substrate 98 present a substantial reduction in the area through which air can pass to reach the smoldering coal of the tobacco rod 22. As a result of deprivation of oxygen in the air, the smoldering coal self-

extinguishes when the burn line reaches opposed zones of add-on material positioned as depicted in FIG. 13. The condition of substantially reduced area for air to support burning of the coal also exists for rotational positions of the tobacco rod 22 between that position illustrated in FIG. 10 and the position illustrated in FIG. 12 when the zones of add-on material do not contact the substrate 98, with FIG. 12 representing the position of most reduction in the area accessible to airflow. Similarly, if the smoking article is placed on a substrate 98 in a position where any of the other pairs of zones of add-on material have substantially the position shown in FIG. 13, self-extinguishment will also likely occur at such other pairs of zones.

[0044] However, when the smoking article is placed on the substrate 98 such that one of the add-on zones contacts the substrate 98, substantially as shown in FIG. 11, the add-on zones may sufficiently restrict the area through which air can pass to the base web, and there is a lesser degree of material cooperation between the substrate 98 and the add-on zones to effect a reduction in that area, in comparison to what occurs at the snuffer zone(s) 101.

[0045] In the foregoing example, the reduction in ignition propensity value, reduction in self-extinguishment value, and improved free-burn quality of a smoking article 20 having a wrapping paper with pattern 30 formed thereon is discussed in relation to a situation where the smoking article happens to be placed on a substrate 98 at one of three specific orientations, the orientations being spaced (off-set) 45 degrees apart from each other. Naturally, the discussion proceeded in this manner for the sake of brevity. It will be readily understood that a pattern according to this description can extinguish the smoking article, regardless of which side portion rests against a substrate 98 and without a need for applying film-forming compound to the paper to such an extent that a desirable free-burn quality in the smoking article is lost. This may be understood by recognizing that opposing zones of film-forming compound need not appear at locations exactly 90 degrees from the side portion in contact with the substrate 98. Those zones may be centered at a location that is closer to or farther from the side portion in contact with the substrate 98, for example, between about 60 degrees and 120 degrees from the side portion in contact with the substrate 98.

[0046] Additionally, for a particular chosen pattern, the ability to extinguish the smoking article may depend more on providing minimum lengthwise extent of add-on material (e.g., a film-forming compound), rather than a particular weight per area of film-forming compound at longitudinal locations. The length of a rectangular zone, for example, may be no less than about 5.5mm for a particular design, base web, and film-forming compound used. The amount of film-forming compound used may be increased to improve ignition propensity performance, usually without losing a free-burn quality, and if desired, a burn accelerator may be applied to the paper to support

even higher add-on levels.

[0047] Preferably, the zones of add-on material reduce permeability of the wrapper paper to the range of from about 0 to about 10 Coresta.

[0048] Previously, it was thought that a permeability ratio of 3:1 between the base web and zones of add-on material was insufficient to extinguish the smoking article because there is an insufficient reduction in the permeability of the paper at the longitudinal location. However, that permeability ratio, over a portion of the circumference of the smoking article, can be sufficient to extinguish the smoking article when the add-on material is located at sides of the smoking article not in contact with the substrate 98 and when there is an underlying substrate 98.

[0049] Accordingly it is seen that the spirally rotated position of the opposed zones of add-on material creates a situation where, regardless of which side portion of the wrapper paper is placed against the substrate 98, there will always be at least one longitudinal location having film-forming compound at side portions not in contact with the substrate 98 yet having a sufficient add-on amount and geometry that the zones can cooperate with the substrate 98 to self-extinguish the smoking article when the burn line reaches that longitudinal location. This fact results in improved ignition propensity performance of the smoking article and permits a smoking article to be designed with an ignition propensity value no greater than 25%. Nevertheless, in the absence of a substrate 98, the smoking article does not self-extinguish yet maintains a free-burn, such as when the smoking article is held by a smoker. This fact results in improved self-extinguishment performance of the smoking article and permits a smoking article to be designed with an self-extinguishment value no greater than 50%, that self-extinguishment value may be the self-extinguishment average value. self-extinguishment values at 0 degrees may be much lower than the SE average value and may be less than 25%.

[0050] In the embodiments described above, the smoking article has a generally circular cross section. Therefore, it is possible for any side portion of the smoking article to rest against the substrate 98. However, a pattern as taught herein can be such that the burn characteristics described above (ignition propensity values no greater than 25% and E values no greater than 50%) in relation to FIGS. 13 and 14 can be realized, regardless of which side portion of the smoking article happens to rest against the substrate 98. Preferably, the pattern is selected so that when the base web is wrapped around a tobacco rod 22, zones of film-forming compound appear at opposing sides not in contact with the substrate 98 at one or more longitudinal locations along the tobacco rod 22. Having more than one longitudinal location with film-forming compound at the side positions is preferred so as to accommodate situations where the smoking article is placed on a substrate 98 after the burn line has advanced through a portion of the smoking article which would have extinguished the smoking article, or so that

side zones of add-on material are always relatively close to a burn line when the smoking article is placed on the substrate 98.

[0051] If desired, the zones of add-on material may also comprise other geometric shapes other than quadrilaterals including, for example, ovals, other polygons, or the like.

[0052] Further, the helix angle Φ described above may be increased while keeping the dimensions of zones the same as in the illustrated embodiments. That change can place the zones in an overlapping pattern (or at least place zones in close proximity to one another). Alternatively, a stepped helical pattern may be formed by increasing the cross-directional dimension of the zones or patches while the helix angle is the same as in FIG. 2 and/or a zone of equal size to that shown in FIG. 2 may be placed between each patch and along paths 34, 36, 36' (so that there are 12, instead of 6 patches along a path 34).

[0053] When the word "about" or the word "approximately" is used herein in connection with a numerical value, the intent is to include not only that numerical value but also values within in a tolerance or range of $\pm 5\%$ of the precise numerical value associated with the corresponding word "about" or the word "approximately".

[0054] It will now be apparent to those skilled in the art that this specification describes a new, useful, and non-obvious smoking article. It will also be apparent to those skilled in the art that numerous modifications, variations, substitutes, and equivalents exist for various aspects of the smoking article that have been described in the detailed description above. Accordingly, it is expressly intended that all such modifications, variations, substitutions, and equivalents that fall within the spirit and scope of the invention, as defined by the appended claims, be embraced thereby.

[0055] In addition to the claims appended hereto, the following numbered clauses define aspects of the invention for which protection may be sought.

1. A smoking article comprising a tobacco rod having a wrapper paper, the wrapper paper having a base web with a nominal permeability and zones of add-on material established according to a pattern, said pattern including a plurality of circumferential regions at spaced locations along the tobacco rod, each region having at least two zones of add-on material with a permeability less than the nominal permeability, the at least two zones being substantially opposed to one another, and for at least every first, second and third consecutive regions, the zones of each second region being circumferentially offset from the zones of the respective first region and the zones of the third region being further circumferentially offset from the zones of the respective first region than the zones of the respective second region; said pattern continuing sufficiently along said tobacco rod such that upon placement of the tobacco rod

upon a substrate and viewed from one end, at least one region will be in an orientation such that its respective zones are situated along side portions of said tobacco rod; and

said zones being of sufficient size, shape and add-on material such that when said tobacco rod is placed upon a substrate in a smoldering condition, the tobacco rod will tend to extinguish at the at least one region in said orientation.

2. A smoking article according to clause 1 wherein the pattern includes additional regions, and the zones of each additional region are more circumferentially offset from zones of said first region than the zones of the region that immediately precedes the additional zone.

3. A smoking article comprising a tobacco rod having an ignition propensity no greater than about 25%, a self-extinguishment value no greater than about 50%, a nominal length, and a wrapper paper, the wrapper paper having:

a base web with a nominal permeability, and a plurality of regions extending along the nominal length of the tobacco rod, each having at least two zones of add-on material with a permeability less than the nominal permeability, the at least two zones being substantially opposed to one another; each region being laterally offset from adjacent regions.

4. A smoking article according to clause 3 wherein the ignition propensity is no greater than about 15%.

5. A smoking article according to clause 3 or 4 wherein the zones of add-on material are generally quadrilateral.

6. A smoking article according to clause 3 or 4 wherein the regions have a longitudinal pitch length along the tobacco rod, and the zones of add-on material have a zone width less than the longitudinal pitch length.

7. A smoking article according to clause 3 or 4 wherein the base web has a permeability greater than about 20 Coresta.

8. A smoking article according to clause 3 or 4 wherein the add-on material occurs on one side of the base web.

9. A smoking article according to clause 3 or 4 wherein the add-on material occurs on two sides of the base web.

10. A smoking article according to clause 3 or 4

wherein the zones of add-on material are applied by printing.

11. A smoking article according to clause 3 or 4 wherein the zones of add-on material are applied by printing in successive layers. 5

12. A smoking article according to clause 3 or 4 wherein each region includes at least two add-on zones circumferentially spaced around the tobacco rod. 10

13. A smoking article according to clause 12 wherein each add-on zone comprises a layer of a starch compound.

14. A smoking article according to clause 3 or 4 wherein each region is laterally offset from an adjacent region by a distance corresponding to the transverse dimension of the add-on zone. 20

15. A smoking article according to clause 3 or 4 wherein each region is laterally offset from an adjacent region so as to define a helical sequence along the base web of zones of add-on material. 25

16. A smoking article comprising:

a tobacco rod having a longitudinal axis and a length; 30
a wrapping paper surrounding the tobacco rod; and

a pattern of film-forming compound disposed on the paper and providing a plurality of discrete shapes, each of which extends over only a portion of the length, 35
wherein at each of a plurality of longitudinal locations along the smoking article only a first and second discrete shape intersects a plane perpendicular to the longitudinal axis and wherein the first shape is disposed only on a first side of the smoking article and the second shape is disposed only on a second side opposite the first side of the smoking article. 40

17. A smoking article according to clause 16 wherein at each of the plurality of longitudinal locations a third side and fourth side opposing the third side are substantially devoid of film-forming compound and separate the first shape from the second shape. 45

18. A smoking article, comprising:

a tobacco rod having a longitudinal axis; 50
a wrapping paper surrounding the tobacco rod; and
a first and second pattern disposed on the paper, providing the only area of reduced permeability 55

for the paper and tracing respective first and second non-overlapping spiral paths over the length of the smoking article,

wherein at each of a plurality of longitudinal positions along the length of the smoking article, a portion of the first pattern is located on only a first side of the smoking article and a portion of the second pattern is located on only a second, opposing side of the smoking article.

Claims

15 1. A smoking article (20) comprising a tobacco rod (22) having a nominal length (L) and a wrapper paper (24), the wrapper paper having:

a base web with a nominal permeability, and a plurality of regions (31 a,b) extending along the nominal length of the tobacco rod, each having at least two zones (34a,b)(36a,b) of add-on material circumferentially spaced around the tobacco rod (22) and with a permeability less than the nominal permeability, 20

wherein the at least two zones (34a,b)(36a,b) of add-on material are substantially opposed to one another and wherein the areas of the base web between adjacent zones are free of add-on material; 25

wherein each zone of a region (31 a,b) is laterally offset from a respective zone of adjacent regions by about 10% to about 35% of the total, unwrapped cross-measure of the base web; and wherein each region (31 a,b) is longitudinally spaced apart from adjacent regions and wherein the areas (33) of the base web between adjacent regions are free of add-on material. 30

40 2. A smoking article (20) according to claim 1 in which each zone of a region (31 a,b) is laterally offset from a respective zone of adjacent regions by about 12% to about 35% of the total, unwrapped cross-measure of the base web. 45

3. A smoking article (20) according to claim 1 or 2 in which the zones of add-on material are generally quadrilateral or triangular.

50 4. A smoking article (20) according to claim 3 in which the zones (70a,b, 72a,b, 74a,b, 76a,b,c) of add-on material are trapezoidal.

5. A smoking article (20) according to claim 3 in which the zones (60a,b, 62a,b, 64a,b, 66a,b,c) of add-on material are parallelograms.

6. A smoking article (20) according to any preceding

claim having an ignition propensity no greater than about 15%.

7. A smoking article (20) according to any preceding claim wherein the regions have a longitudinal pitch length along the tobacco rod (22), and the zones of add-on material have a zone width less than the longitudinal pitch length. 5
8. A smoking article (20) according to any preceding claim wherein the base web has a permeability greater than about 20 Coresta. 10
9. A smoking article (20) according to any preceding claim wherein the add-on material occurs on one side of the base web. 15
10. A smoking article (20) according to any preceding claim wherein the add-on material occurs on two sides of the base web. 20
11. A smoking article (20) according to any preceding claim wherein the zones of add-on material are applied by printing. 25
12. A smoking article (20) according to any preceding claim wherein the zones of add-on material are applied by printing in successive layers.
13. A smoking article (20) according to any preceding claim in which the path defined by corresponding geometric features of zones in adjacent regions is a stepped helix. 30
14. A smoking article (20) according to any preceding claim wherein each cross-web aligned pair of zones of add-on material covers up to 33% of the area of the respective region. 35
15. A smoking article (20) comprising a tobacco rod (22) having an ignition propensity no greater than about 25%, a self-extinguishment value no greater than about 50%, a nominal length, and a wrapper paper, the wrapper paper having: 40

a base web with a nominal permeability, and a plurality of regions (31a,b) extending along the nominal length of the tobacco rod, each having at least two zones (34a,b)(36a,b) of add-on material with a permeability less than the nominal permeability, the at least two zones being substantially opposed to one another, each region being laterally offset from adjacent regions. 50

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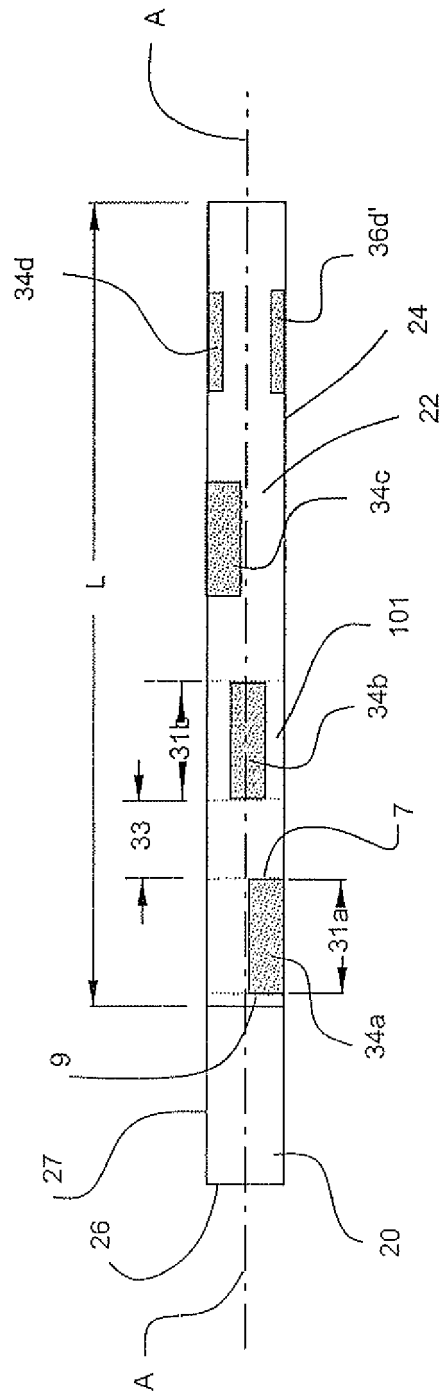


FIG. 1

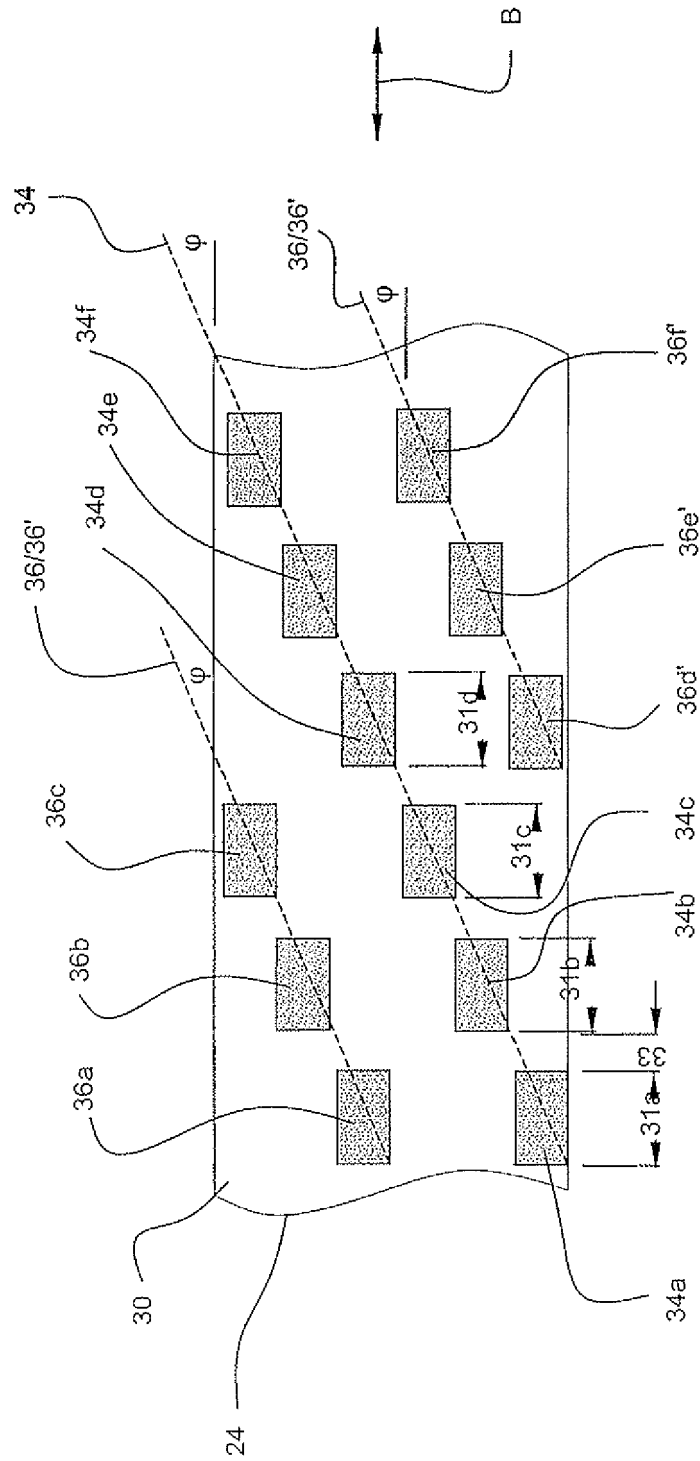


FIG. 2

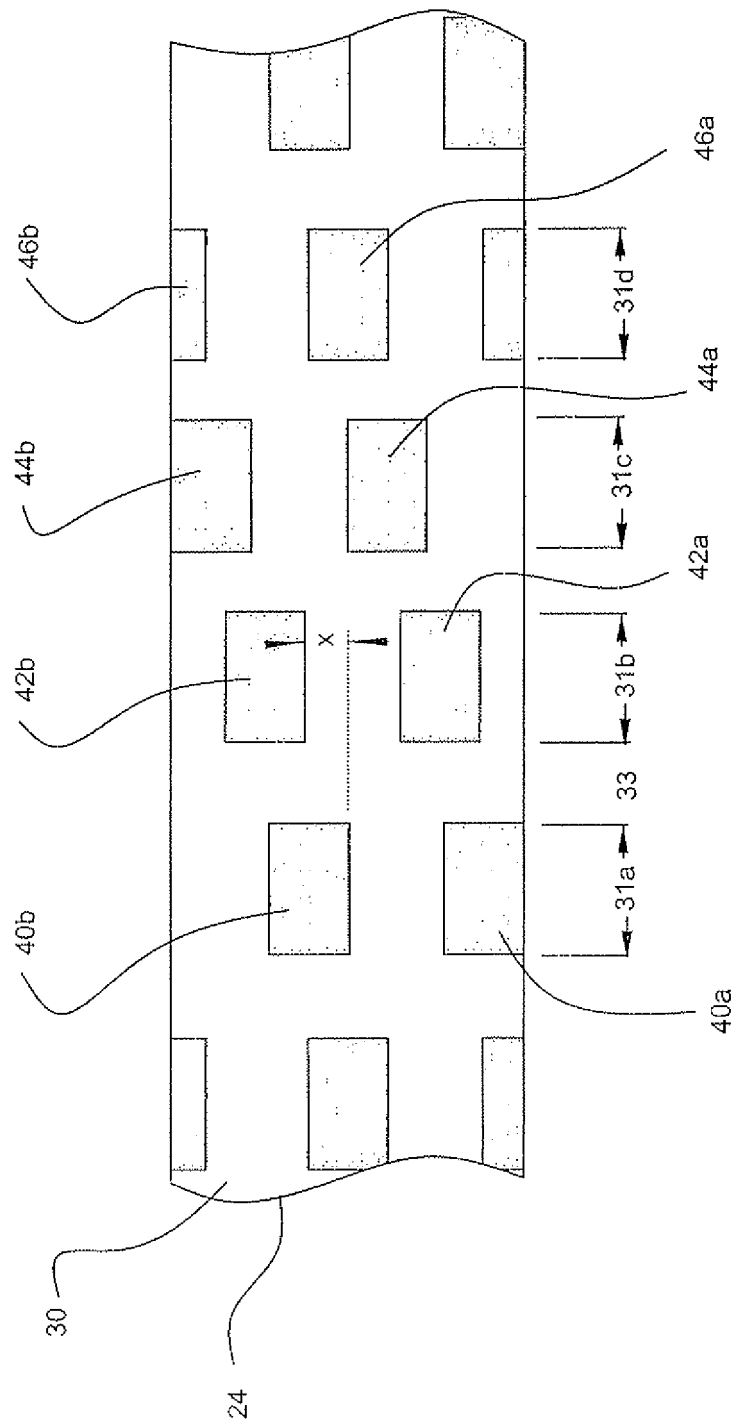


FIG. 3

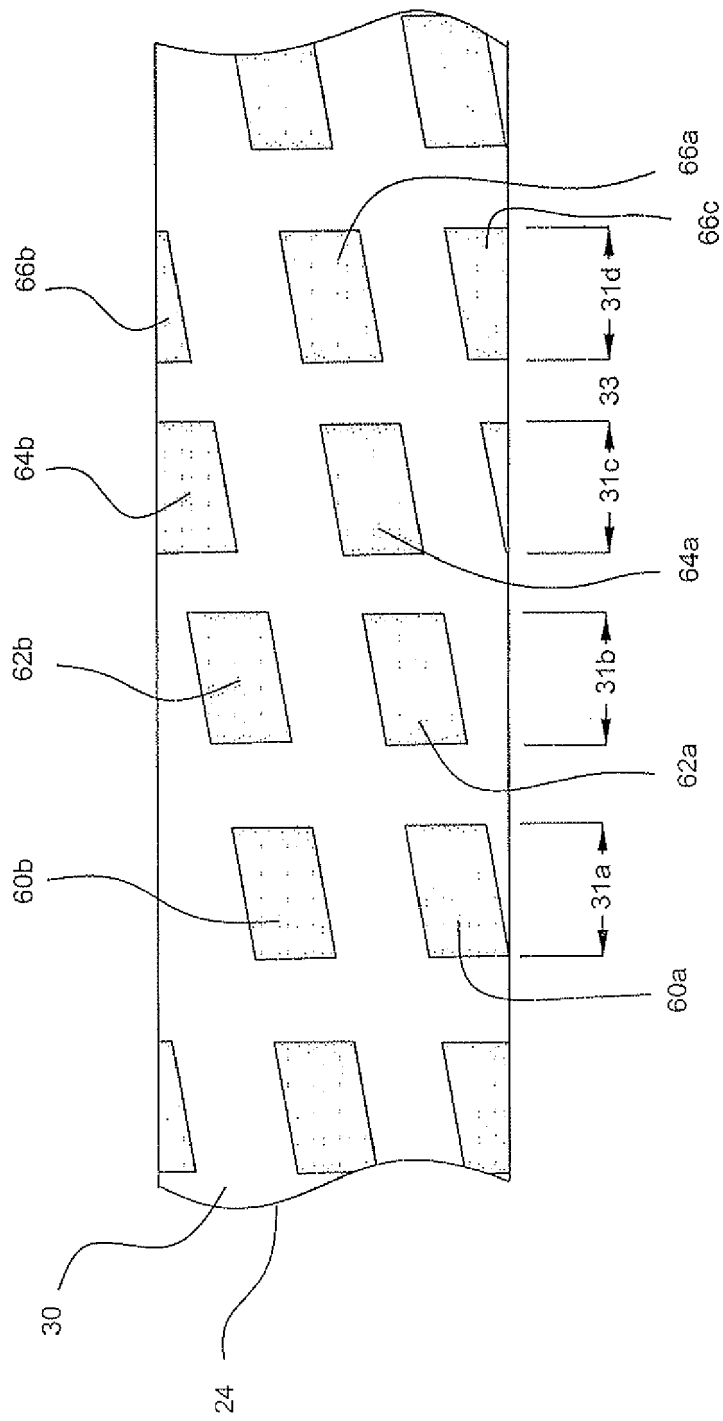


FIG. 4

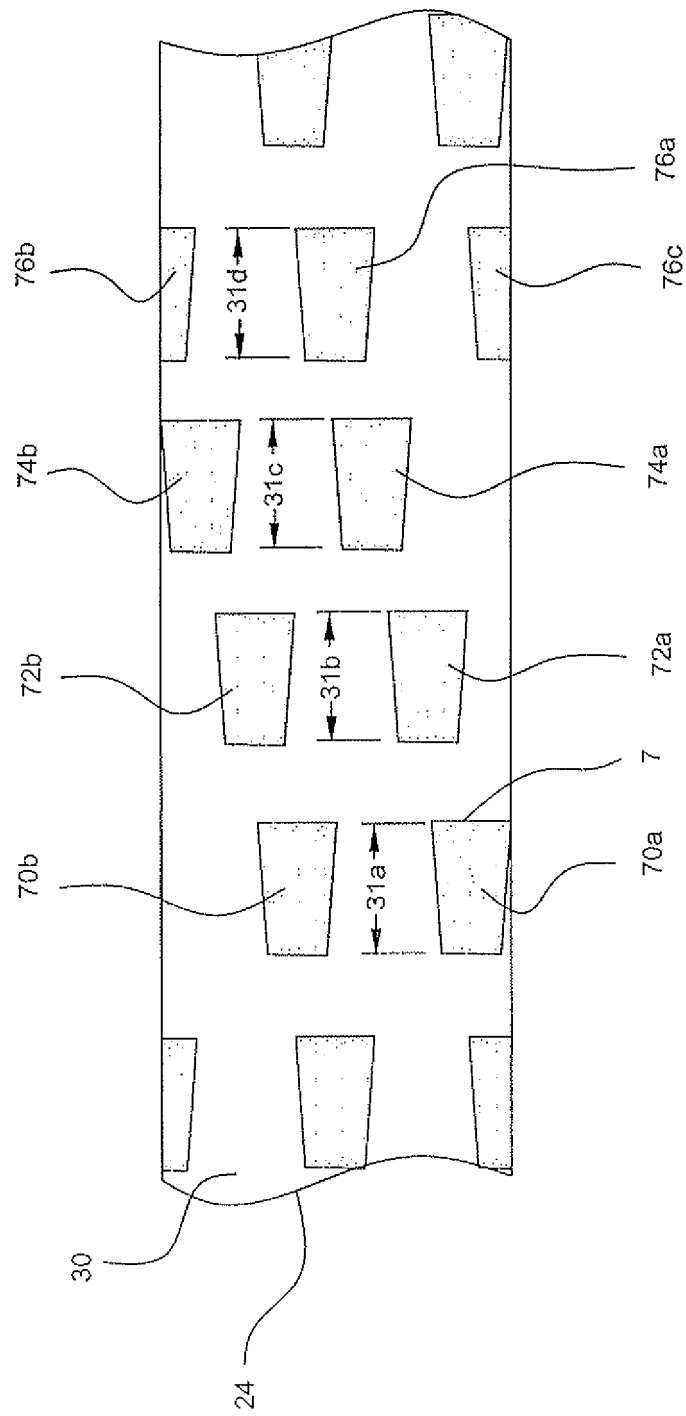


FIG. 5

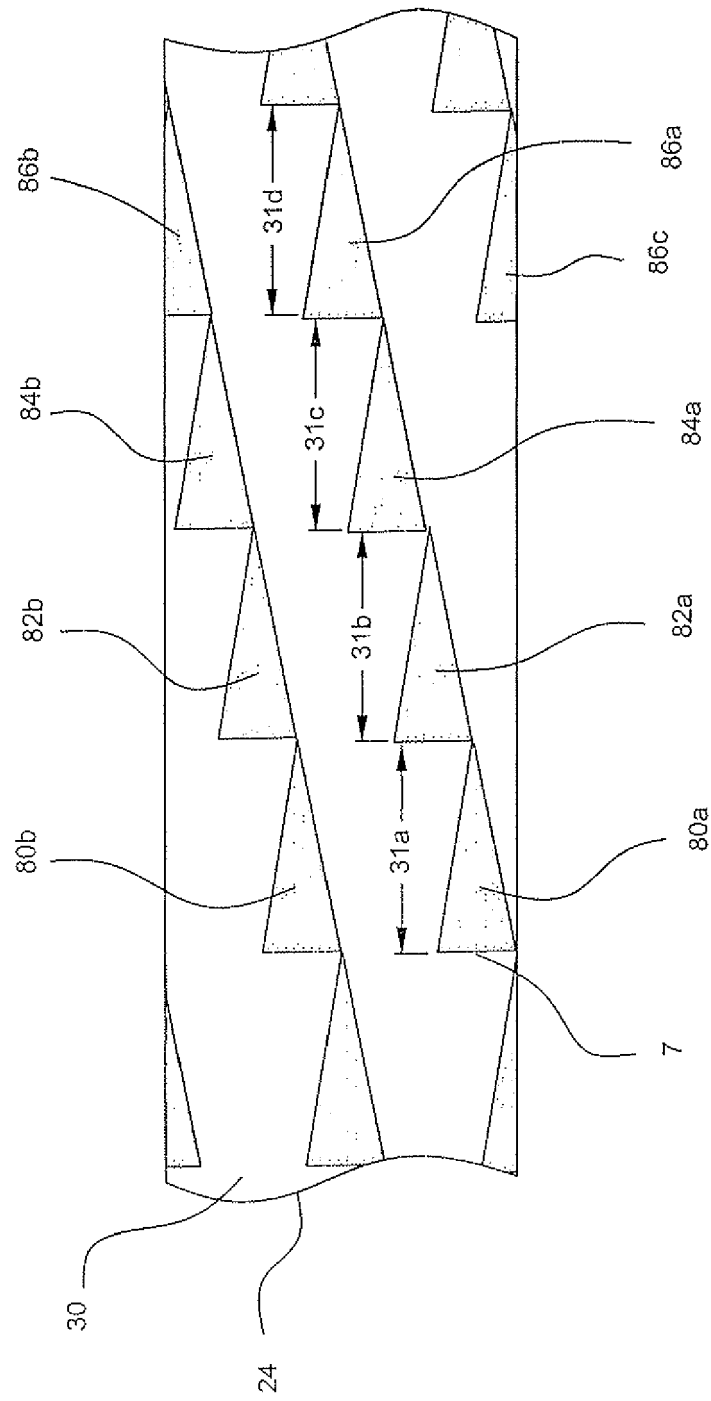


FIG. 6

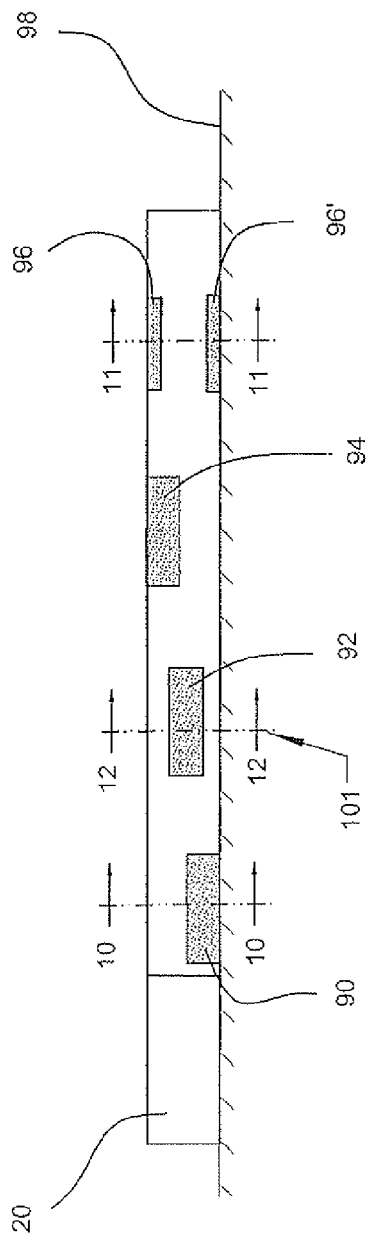


FIG. 7

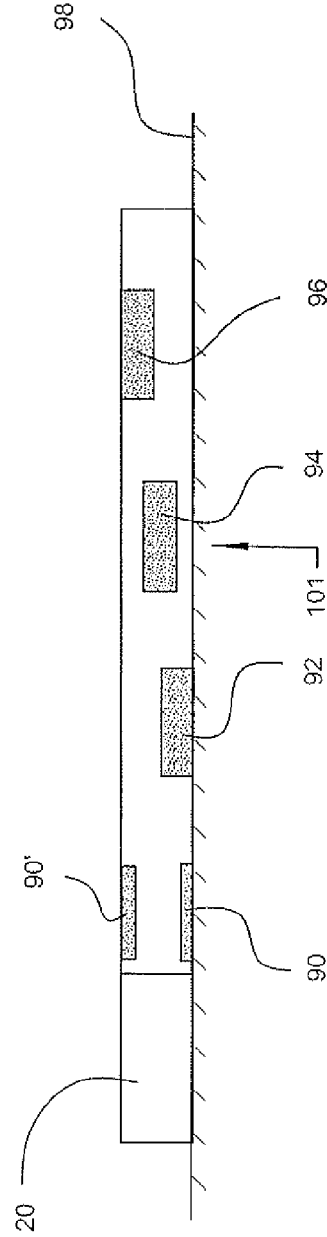


FIG. 8

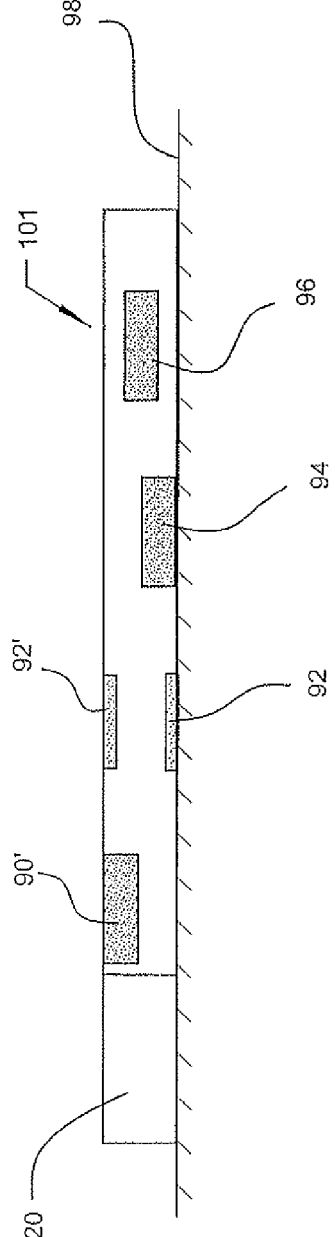


FIG. 9

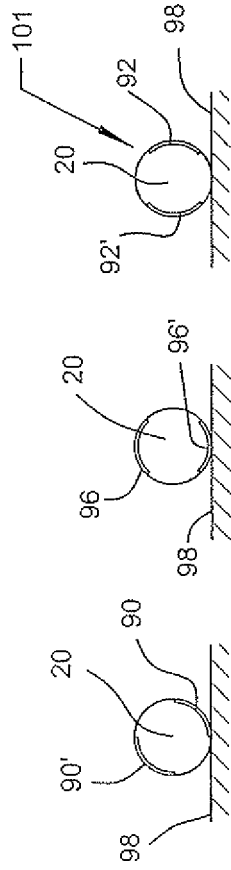


FIG. 12

FIG. 11

FIG. 10

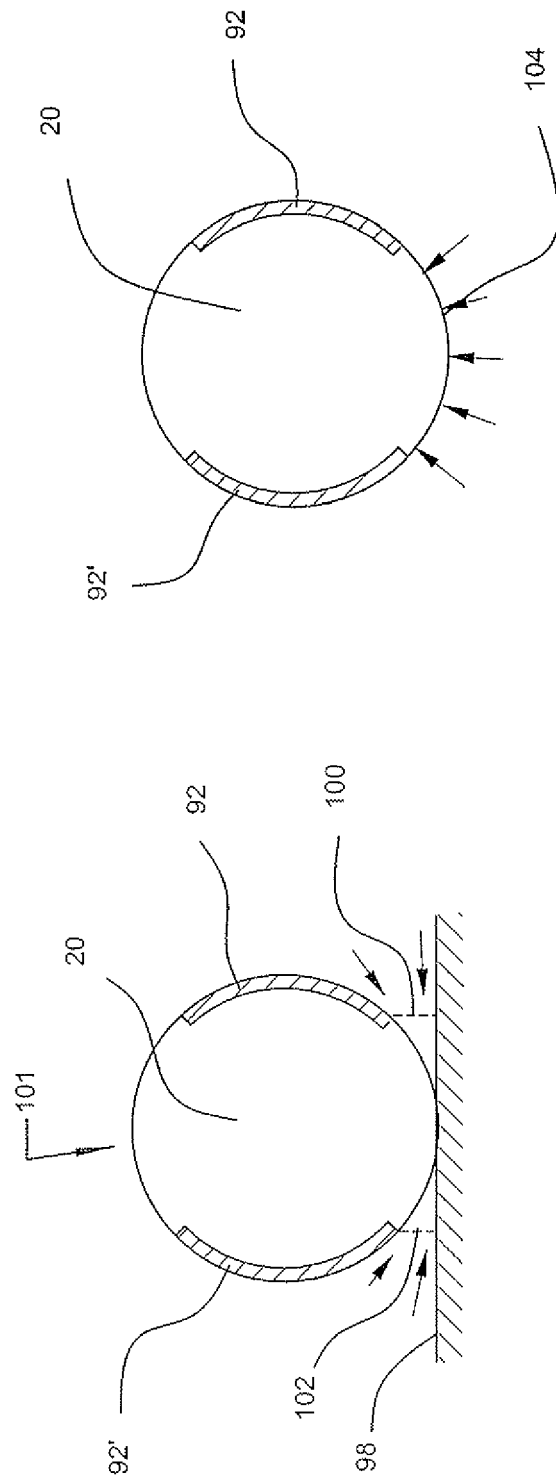


FIG. 14

FIG. 13



EUROPEAN SEARCH REPORT

Application Number
EP 13 16 3630

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 878 754 A (PETERSON RICHARD M [US] ET AL) 9 March 1999 (1999-03-09)	1-5,7-14	INV. A24D1/02
Y	* column 5, line 42 - column 11, line 43; figures 3A-5F *	6,15	
X	US 3 903 899 A (MUSILLO ROBERT G) 9 September 1975 (1975-09-09)	1,2,9,10,13,14	
A	* column 1, line 3 - column 2, line 41; figures 1-5 *	3-8,15	
Y	Health Canada / Santé Canada: "Cigarette Ignition Propensity Regulations", Internet 30 September 2005 (2005-09-30), page 1, XP002697884, Retrieved from the Internet: URL: http://www.hc-sc.gc.ca/hc-ps/alt_formats/hecs-sesc/pdf/pubs/tobac-tabac/ignition-incend/ignition-incend-eng.pdf [retrieved on 2013-05-29] * page 1 *	6,15	
A	US 3 667 479 A (SANFORD ROBERT A ET AL) 6 June 1972 (1972-06-06)	4	TECHNICAL FIELDS SEARCHED (IPC) A24D
A	US 2004/261805 A1 (WANNA JOSEPH T [US] ET AL) 30 December 2004 (2004-12-30)	1-15	
	* paragraphs [0002], [0003], [0019] - paragraph [0023]; figures 2D,2E,2G,2H *		
	-/--		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 May 2013	Examiner Maier, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 13 16 3630

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GLOGAN, TIM: "Making fire-safe cigarettes a hot topic", TOBACCO JOURNAL INTERNATIONAL, vol. 2004, no. 2, 31 March 2004 (2004-03-31), pages 64-65, XP002562191, * the whole document *	1-15	
A	ROSSEL, STEFANIE: "Canada's burning issue", TOBACCO JOURNAL INTERNATIONAL, vol. 2005, no. 4, 1 August 2005 (2005-08-01), pages 88-91, XP002562192, * the whole document *	1-15	
A	Anonymous: "ASTM E 2187-04: Standard test method for measuring the ignition strength of cigarettes.", ASTM 31 August 2004 (2004-08-31), pages 1295-1302, XP002697851, Retrieved from the Internet: URL: http://ia700808.us.archive.org/32/items/gov.law.astm.e2187.2004/astm.e2187.2004.pdf [retrieved on 2013-05-29] * the whole document *	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
Place of search Munich		Date of completion of the search 31 May 2013	Examiner Maier, Michael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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Application Number

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☒ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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31-05-2013

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5878754	A	09-03-1999	AT 219894 T	15-07-2002
			BR 9806627 A	20-03-2001
			CA 2231390 A1	10-09-1998
			DE 69806286 D1	08-08-2002
			DE 69806286 T2	31-10-2002
			EP 0864259 A2	16-09-1998
			ES 2179392 T3	16-01-2003
			JP 3910717 B2	25-04-2007
			JP H11151082 A	08-06-1999
			US 5878754 A	09-03-1999

US 3903899	A	09-09-1975	NONE	

US 3667479	A	06-06-1972	BE 761756 A1	19-07-1971
			CH 536609 A	15-05-1973
			DE 2101597 A1	29-07-1971
			FR 2077209 A1	22-10-1971
			GB 1255290 A	01-12-1971
			NL 7100617 A	21-07-1971
			SE 369370 B	26-08-1974
			US 3667479 A	06-06-1972
			ZA 7100168 A	29-12-1971

US 2004261805	A1	30-12-2004	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 11500918 B [0034]