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(2) Date: **Feb. 27, 2018**(57) **ABSTRACT**

The present invention relates to a smoking article comprising a tobacco rod, a filter comprising at least one plug of filtration material wrapped with one or more filter wrappers, and a tipping material attaching the tobacco rod and the filter, wherein the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre.

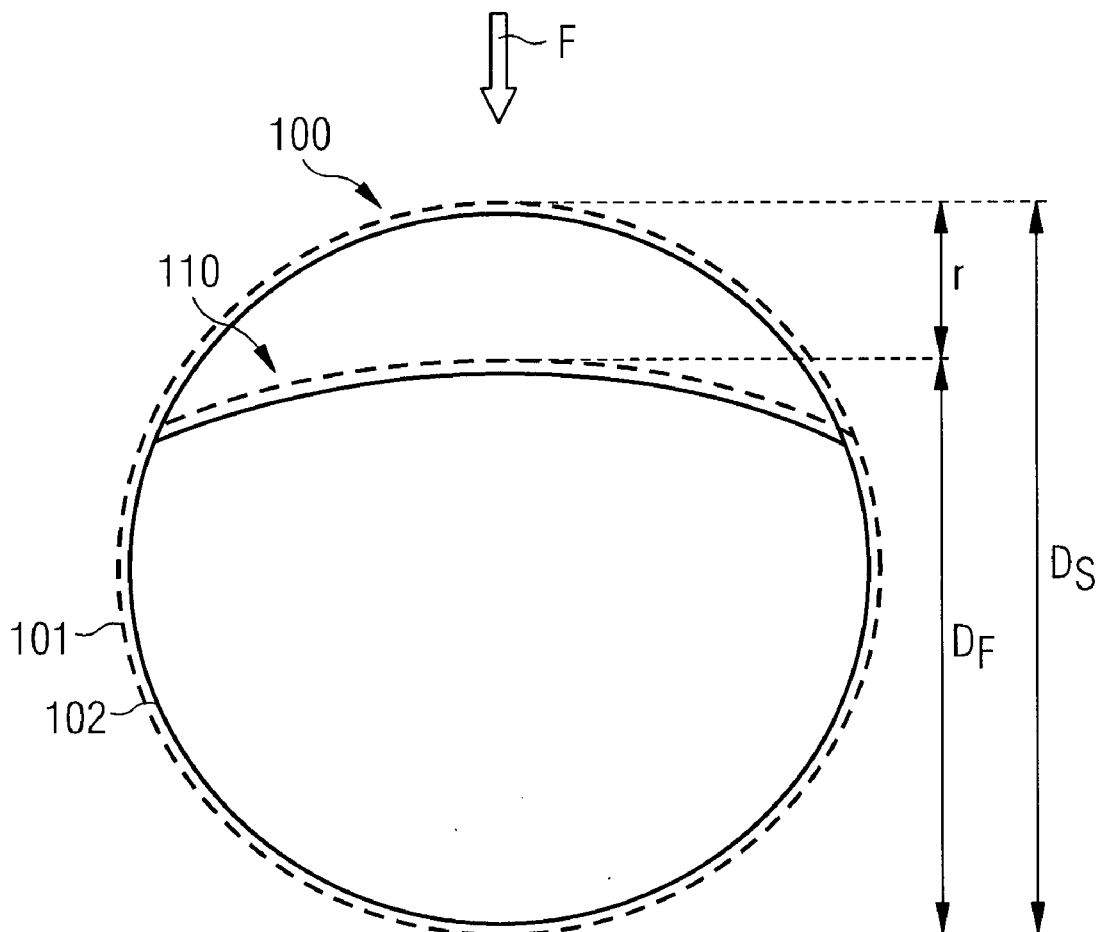


FIG 1

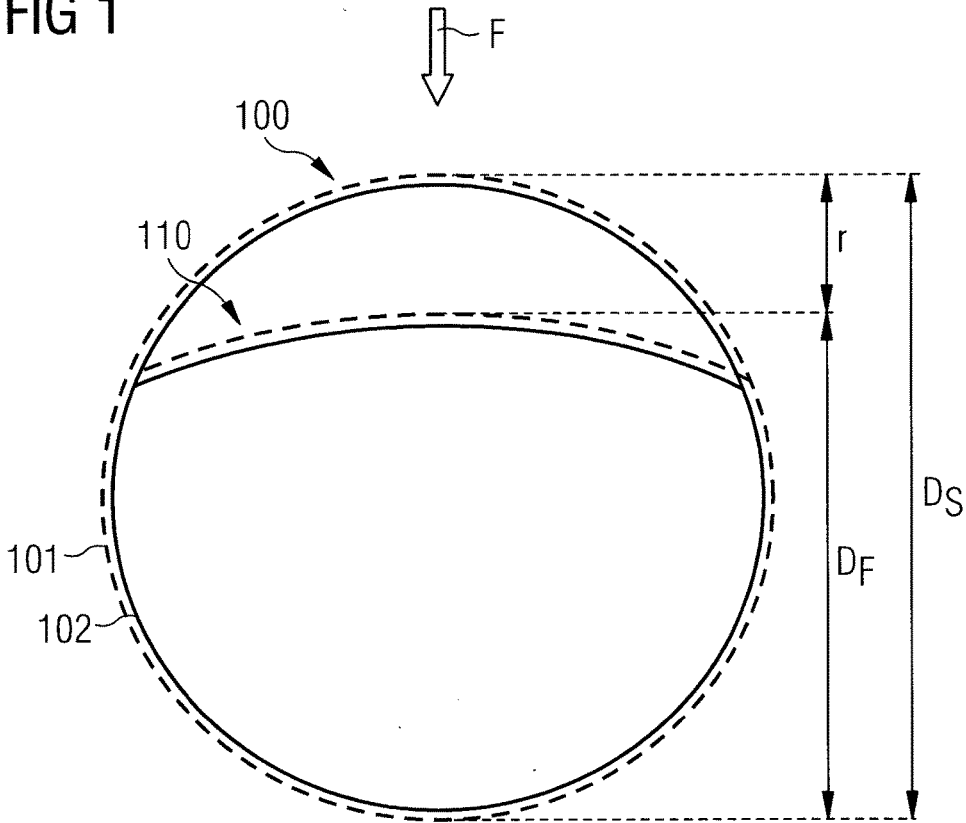


FIG 2

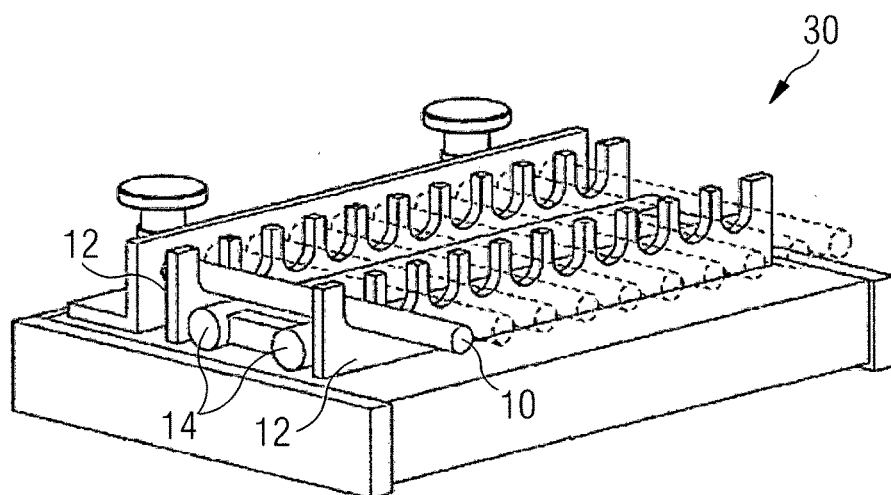
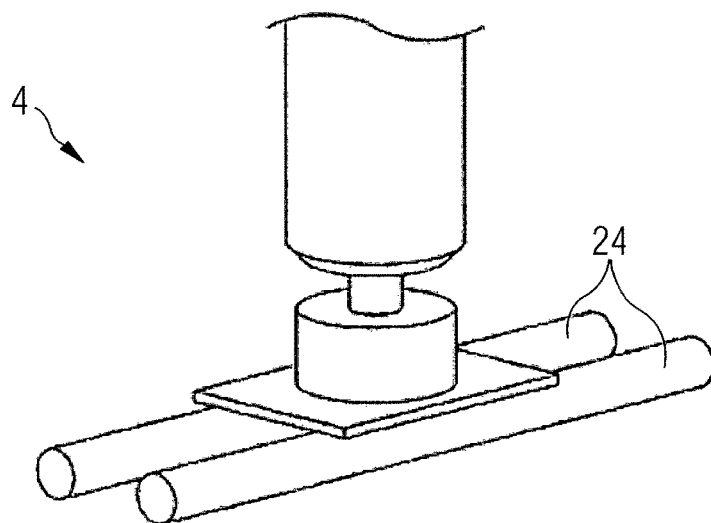


FIG 3

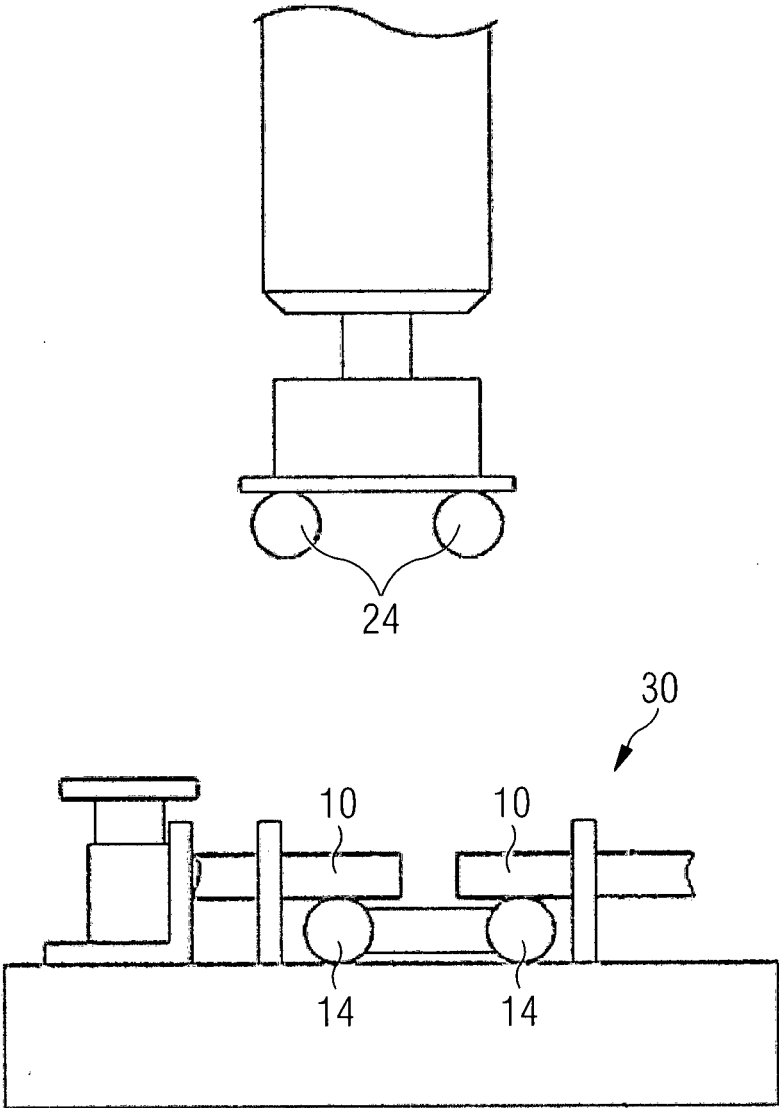
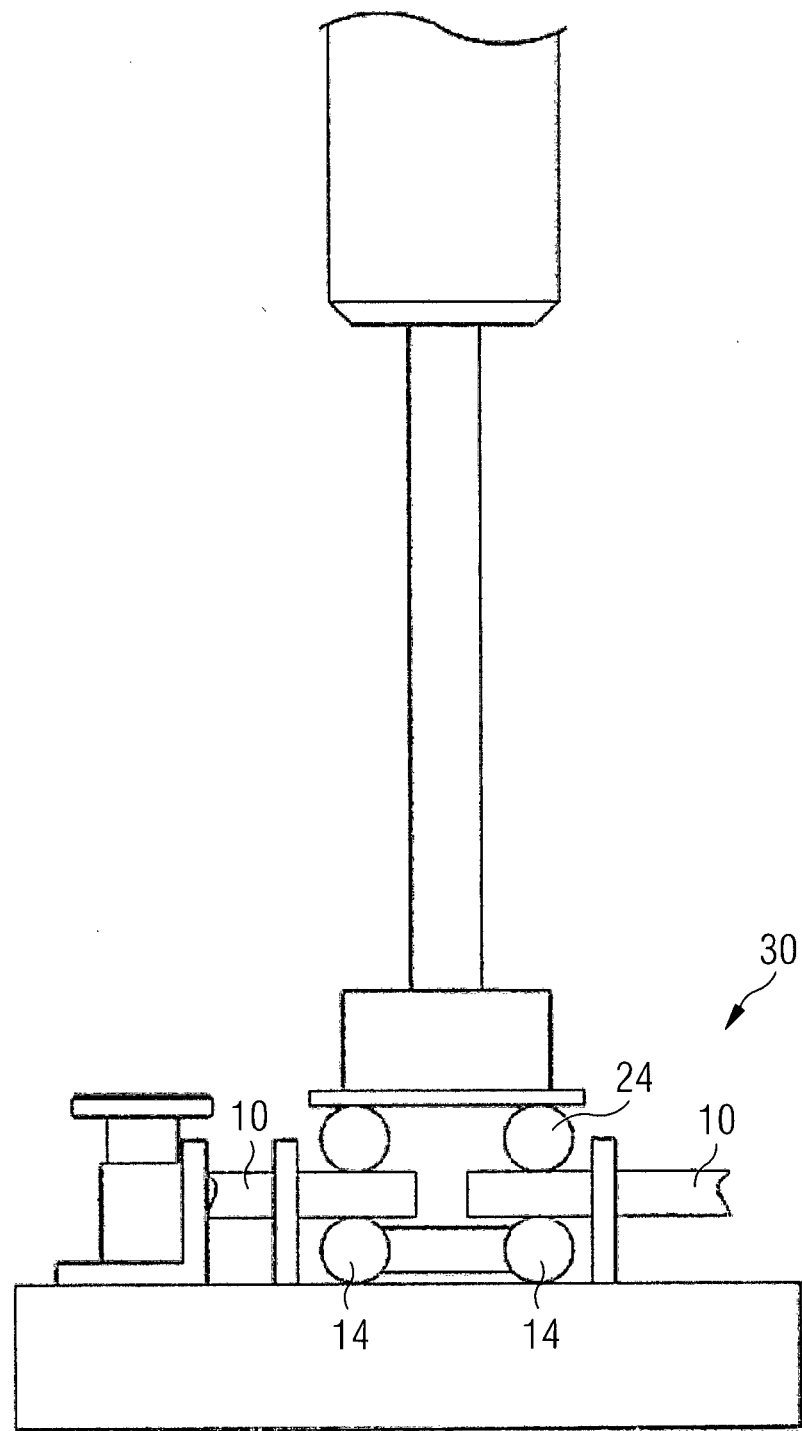


FIG 4



SMOKING ARTICLE

FIELD OF THE INVENTION

[0001] The present invention relates to a filter for a smoking article, a smoking article comprising said filter and the use of said filter in a smoking article.

BACKGROUND OF THE INVENTION

[0002] Smoking articles such as cigarettes usually comprise a rod of tobacco or other aerosol forming material wrapped in a combustible wrapper, usually cigarette paper, and a filter aligned in end-to-end relationship with said tobacco rod. The filter may include at least one plug of cellulose acetate tow attached to the tobacco rod or other aerosol forming material by tipping paper which overlies the filter and an adjacent end of the tobacco rod against which the filter is placed in abutment. Perforations may further be provided in the filter through the tipping paper to allow ventilation of the smoke drawn by consumers through the filter upon smoking.

[0003] Consumers nowadays expect from any consumer goods products of the best possible quality for the best consumer experience possible and they pay more and more attention to perceived quality in the presentation and look and feel of the products, which becomes sometimes as important as other features like the taste or functional benefits of products. This holds true for smoking articles as for any other consumer good product and a particular area of focus from consumers to judge the quality of smoking articles lies in the visual appearance and physical behavior thereof when consumers hold it in their hands and mouth before and during consumption.

[0004] In particular consumers expect smoking articles to present uniform density in the tobacco or other aerosol generating material rod as well as substantial rigidity or firmness of the filter when held between fingers or the lips, altogether with a nice uniform rounded shape of the filter and smoking article as a whole. Appropriate firmness of the filter is particularly important to provide consumers perception of increased quality through resistance of the filter to crushing strength between the fingers and lips. At the same time, firmness must not be too high to keep a certain softness in the mouth and comfort during use for consumers. Regular, uniform roundness of the filter and smoking article is also important for perceived quality as uneven shapes give an impression of lower quality of the products.

[0005] There are multiple factors that influence both the firmness and roundness of smoking articles filters, including among others cellulose acetate tow weight, plasticizer content and filter wrappers qualities (basis weight, thickness, porosity). All these factors need to be adjusted appropriately to provide the appropriate level of firmness and roundness while at the same time meeting expected sensory and taste targets for the products. In particular, only increasing the quantity of plasticizer such as triacetin used to form the cellulose acetate filter plug(s) in order to increase the firmness thereof will be effective but to the detriment of the taste neutrality of the product. Indeed, in high concentration triacetin tends to degrade into acetic acid, which consumer can feel and smell in the smoking articles.

[0006] There have been attempts in the prior art to increase filter firmness by essentially using thicker filter plug wrappers such as disclosed in WO 2015007399 A1, WO

2015007400 A1 and WO 2015007401 A1. Those documents disclose smoking articles comprising a tobacco rod and a filter having a plug of filtration material extending to the furthest downstream end, also called mouth end of the filter, the plug being surrounded by one or more filter wrappers; and tipping material attaching the tobacco rod and the filter. The one or more filter wrappers have a basis weight between about 50 grams per square metre and about 100 grams per square metre, the hardness of the filter consequently achieved being of at least 90%.

[0007] The above cited patent applications basically propose to use thick filter wrappers having a basis weight between about 50 grams per square metre and about 100 grams per square metre such as known and used in the prior art for manufacturing recessed filters (see for example WO 2011/117584 A1). This indeed provides, exactly like expected and achieved with recess filters, an increased resistance to crush at the mouth end of the filter due to the higher basis weight and thickness of the filter wrappers, further increased by the cellulose acetate extending to the end of the mouth end of the filter.

[0008] However, such filter configuration with thick, heavy basis weight filter wrappers has several drawbacks, in particular in terms of manufacturing and costs. Indeed, the use of thick filter wrappers having a basis weight between about 50 grams per square metre and about 100 grams per square metre requires substantial speed reduction, up to 25-30%, compared to the nominal speeds of filter making machines for standard filter wrappers of between 20 and 30 grams per square metre. Further adjustments on the filter maker during brand changes are required, or even specific machine parts have to be changed, reducing the productivity and increasing the production cost. Use of thicker filter wrappers also requires more frequent cleaning of the filter makers due to dust generation during processing which further impacts negatively the manufacturing efficiency and costs. Finally thick filter wrappers show less elasticity than standard thinner filter wrappers what generates lesser rounded filter once the filter wrappers are wrapped around the cellulose acetate plugs of the filter due to the innate rigidity of the wrappers.

[0009] There's consequently a need for a smoking article having another filter configuration showing at the same time increased firmness and uniform roundness for increased quality perception by consumers with limited, if any, impact on manufacturing speeds and costs compared to the prior art previously described.

[0010] One object of the present invention is to provide an improved smoking article comprising a filter solving the above needs.

SUMMARY OF THE INVENTION

[0011] According to a first aspect of the invention, the inventors found that the disadvantages of the prior art smoking articles can be overcome by a smoking article, for example, a cigarette, comprising:

[0012] a tobacco rod;

[0013] a filter comprising at least one plug of filtration material wrapped with one or more filter wrappers; and

[0014] a tipping material attaching the tobacco rod and the filter;

[0015] wherein the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre.

[0016] The at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10%. The plasticizer content may be of between about 7% and 10%, such as of between about 7% and 9%, such as of between about 6% and 8%, for example of about 8%. By providing these values of plasticizer content, a desired filter hardness may be obtained while preventing damaging the filtration material.

[0017] The hardness of the smoking article measured at any point of the filter when attached to the tobacco rod by tipping material may be less than about 90%.

[0018] Advantageously, the inventors have found that hardness values of below 90% can be achieved by merely using plug wrappers having a basis weight of more than 32 grams per square metre and less than 50 grams per square metre for the plug(s) of filtration material in the filter without increasing the content of plasticizer used in the filtration material, while offering easy machinability of the plug wrappers during manufacturing of the smoking articles, thereby not increasing the machine costs, and further allowing easy online laser perforation of the filter, what requires extreme care and powerful lasers when plug wrappers having a basis weight of 50 grams per square metre and higher are used.

[0019] According to a second aspect, the invention relates to a filter for a smoking article. The filter has at least one plug of filtration material wrapped with one or more filter wrappers, where the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre. The at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10%. The plasticizer content may be of between about 7% and 10%, such as of between about 7% and 9%, such as of between about 6% and 8%, for example of about 8%.

[0020] According to a third aspect, the invention relates to the use of the filter according to the second aspect of the invention in a smoking article.

[0021] Further exemplary embodiments of the invention are indicated in the dependent claims and the following detailed description, which, however, do not restrict the scope of the invention and only help to understand and explain the features of the present invention. Deviations and modifications on these particular features, particular in regard to other aspects of the invention, can be made without departing from the scope of the invention.

DESCRIPTION OF THE FIGURES

[0022] FIG. 1 illustrates the definition of the hardness value as used throughout the description.

[0023] FIG. 2 illustrates a perspective view of an apparatus for determining the hardness of a filter or a smoking article, in a first configuration;

[0024] FIG. 3 illustrates a side view of the apparatus of FIG. 2, in a first configuration;

[0025] FIG. 4 illustrates a side view of the apparatus of FIG. 2, in a second configuration.

DETAILED DESCRIPTION

[0026] All ranges disclosed herein are to be considered to be supplemented by the term “about”, unless clearly defined to the contrary or otherwise clear from the context.

[0027] All numbers or percentages relating to amounts of a substance within this application are given in wt. %, unless clearly defined to the contrary or otherwise clear from the context.

[0028] According to a first aspect the invention relates to a smoking article, for example, a cigarette, comprising:

[0029] a tobacco rod;

[0030] a filter comprising at least one plug of filtration material wrapped with one or more filter wrappers; and

[0031] a tipping material attaching the tobacco rod and the filter;

[0032] wherein the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre, and the at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10%.

[0033] The hardness of the smoking article measured at any point of the filter when attached to the tobacco rod by tipping material may be less than about 90%.

[0034] Advantageously, the inventors have found that hardness values of below 90% can be achieved by using merely plug wrappers having a basis weight of more than 32 grams per square metre and less than 50 grams per square metre for the plug(s) of filtration material in the filter without increasing the content of plasticizer used in the filtration material, while offering easy machinability of the plug wrappers during manufacturing of the smoking articles, thereby not increasing the machine costs, and further allowing easy online laser perforation of the filter, what requires extreme care and powerful lasers when plug wrappers having a basis weight of 50 grams per square metre and higher are used.

[0035] Throughout the present disclosure the hardness values specified for the smoking articles according to the invention correspond to hardness measurements obtained submitting the smoking articles to the DD60A test, i.e. using a known DD60A Densimeter (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany) device.

[0036] The term “hardness” as used throughout the present disclosure characterizes the resistance to deform. Hardness values are generally expressed as percentage. FIG. 1 shows a cigarette **100**, comprising a filter wrapper **102** and a tipping material **101**, before applying a load F and the same cigarette **110** whilst applying load F . The cigarette **100** before the load F has been applied has a diameter D_S . The cigarette **110** after applying a set load for a set duration (but with the load still applied) has a (reduced) diameter D_F . The reduction of the diameter (r) is $r=D_S-D_F$. Referring to FIG. 1, the hardness is defined as follows:

$$\text{Hardness(\%)} = \frac{D_F}{D_S} \times 100\%$$

[0037] wherein D_S is the initial (non-depressed) diameter of the cigarette, and D_F is the depressed diameter after applying a set load for a set duration. The harder the material, the closer the hardness is to 100%.

[0038] As is described in more detail below, and generally known in the art, to determine the hardness of a portion (such as a filter) of a smoking article, smoking articles should be aligned parallel in a plane and the same portion of each smoking article to be tested should be subjected to a set

load for a set duration. This test is performed using a known DD60A Densimeter device (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany), which is fitted with a measuring head for cigarettes and with a cigarette receptacle. The load is applied using two load applying cylindrical rods, which extend across the diameter of all of the smoking articles at once. According to the standard test method for this instrument, the test should be performed such that twenty contact points occur between the smoking articles and the load applying cylindrical rods. In some cases, the filters to be tested may be long enough such that only ten smoking articles are needed to form twenty contact points, with each smoking article contacting both load applying rods (because they are long enough to extend between the rods). In other cases, if the filters are too short to achieve this, then twenty smoking articles should be used to form the twenty contact points, with each smoking article contacting only one of the load applying rods, as further discussed below. Two further stationary cylindrical rods are located underneath the smoking articles, to support the smoking articles and counteract the load applied by each of the load applying cylindrical rods. Such an arrangement is described in more detail below, and shown in FIGS. 2 to 4 which represent a known prior art arrangement as disclosed e.g. in WO 2015/007400 A1 and WO 2015/007401 A1.

[0039] For the standard operating procedure for such an apparatus, an overall load of 2 kg is applied for a duration of 20 seconds. After 20 seconds have elapsed (and with the load still being applied to the smoking articles), the reduction of the diameter (r) in the load applying cylindrical rods is determined, and then used to calculate the hardness from the above equation. The temperature is kept in the region of $22^{\circ}\text{C} \pm 2^{\circ}$. The test described above is referred to as the DD60A Test. The DD60A Test and corresponding apparatus are described in more detail below in relation to FIGS. 2 to 4. As discussed in more detail below, the hardness of a filter portion of a smoking article does not greatly differ when the smoking article is smoked rather than unsmoked. However, the standard way to measure the filter hardness is when the smoking article is unsmoked.

[0040] In an embodiment of the invention, the hardness of the smoking article measured at any point of the filter when attached to the tobacco rod by tipping material is less than about 90% but higher than about 85%; for example, the hardness is in the range of between 86% and 88%.

[0041] The inventors have interestingly found out through consumer studies and experimentation of various filter structure that consumers could actually feel an increase in filter hardness in their fingers and on their lips only once the hardness value reached 85% and more compared with standard filter cigarettes available, i.e. cigarettes having filters comprising filter wrappers on between about 20 grams per square metre and 30 grams per square metre, which allow to achieve hardness of about 85% in combination with standard plasticizer contents of about 4 to 6% by weight of filter tow material. Even more interestingly studies carried out by the inventors have shown that consumers did not substantially perceive an increase in filter hardness above 90%, and certainly not perceive filters having a hardness of above 90% as of having an increased quality compared to those having only a hardness of between 85% and 90%. However smoking articles showing a hardness of 90% or more require the use of either thicker filter wrappers of at least 50 grams per square metre or more and/or the use of

higher contents of plasticizer in the filter tow material, with the downsides mentioned above.

[0042] The one or more filter wrappers may comprise any suitable material or combination of materials. Examples of suitable materials include, but are not limited to, cellulose based materials, cellulose based film, cardboard, paper, recon, and combinations thereof. According to certain embodiments, the one or more filter wrappers comprise paper.

[0043] In an embodiment of the invention, one or more filter wrappers have a basis weight of between about 38 and about 49 grams per square metre, such as of between about 42 and about 48 grams per square metre, for example of about 45 grams per square metre.

[0044] The one or more filter wrappers may have a thickness of between about 50 to about 60 microns, for example of about 55 microns. Such range of thickness for the filter wrapper(s) of the filter further eases machinability of the smoking article's filter and additionally contributes to provide a proper roundness of the filter in the finished smoking article.

[0045] The one or more filter wrappers may have low porosity. In some embodiments, the one or more filter wrappers have a porosity of less than about 1000 Coresta units, such as less than about 500 Coresta units, or such as less than about 100 Coresta units. The porosity may be as low as 100 Coresta units or lower, or 20 Coresta units or lower. In addition, or in the alternative, the porosity may be more than about 1 Coresta unit. Such low porosity filter wrappers may help to improve the strength of the filter, and may help to increase the critical load of the smoking article. This can be particularly beneficial when the filter includes perforations extending through the tipping paper and the one or more filter wrappers.

[0046] The one or more filter wrappers of the filter may be non-porous wrappers.

[0047] The filtration material may comprise any suitable material or combination of materials. The type of filtration material may be selected to provide the desired hardness. Examples of suitable materials include, but are not limited to, cellulose acetate, cellulose, reconstituted cellulose, polylactic acid, polyvinyl alcohol, nylon, polyhydroxybutyrate, thermoplastic material, such as starch, non-woven materials, longitudinally oriented fibres and randomly oriented fibres, paper, crepe, PLA fibres, and combinations thereof. All or part of the filter may include activated carbon or other sorbent material. The filter may include an adhesive or plasticizer or a combination thereof. According to certain embodiments, the filtration material comprises cellulose acetate.

[0048] The filtration material may have any suitable denier per filament (dpf) and total denier (td). In certain embodiments, the filtration material may have a denier per filament (dpf) of between 1.5 to 6.0, such as 2.0 to 5.0, such as 3.0 to 5.0, for example of about 3.8. The filter segment may have a total denier of less than about 40,000, such as less than about 38,000, such as less than about 35,000, such as less than about 33,000, for example of about 30,000.

[0049] In an embodiment where the filter has a length of between about 20 mm to 30 mm and a circumference of between about 20 mm to about 25 mm, the filter may have a tow weight in the range from about 90 mg to about 160 mg, such as in the range from about 100 mg to about 150 mg, such as in the range from about 120 mg to about 140 mg,

such as in the range from about 130 mg to about 138 mg, for example of about 136.25 mg.

[0050] The at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10% per weight of filtration material, such as of between about 7% and 10%, for example of about 8%. According to certain embodiments, as plasticizer triacetin is used.

[0051] The tipping material may comprise any suitable material or combination of materials. Examples of suitable materials include, but are not limited to, cellulose based materials, cellulose based film, cardboard, paper, recon, and combinations thereof. According to certain embodiments, the tipping material comprises paper.

[0052] In an embodiment, the filtration material comprises cellulose acetate, having triacetin as plasticizer, the one or more filter wrappers comprise paper, and the tipping material comprises paper.

[0053] The tipping material may have a basis weight in a range from about 30 g/m² to about 44 g/m², such as in a range from about 31 g/m² to about 40 g/m², such as in a range from about 31 g/m² to about 38 g/m², for example of about 31 g/m².

[0054] The tipping material may include a ventilation zone at a location about the filter. The ventilation zone may comprise perforations through the tipping material. The amount of ventilation, including the number, layout, position and size of perforations, may be selected to provide the desired level of ventilation.

[0055] The perforations may extend through the filter wrapper or wrappers surrounding the plug of filtration material. Alternatively, the filter wrapper or wrappers may be porous. The tipping material may be standard pre-perforated tipping material. Alternatively, the tipping material may be perforated in-line (for example, using a laser) during the manufacturing process according to the desired number, size and position of the perforations. When in-line perforations are made on the tipping material, these may be made simultaneously on the filter wrapper or wrappers.

[0056] In one embodiment the filter comprises a single plug of filtration material wrapped with a single filter wrapper. In such embodiment the plug of filtration material may extend along the whole length of the filter.

[0057] In a further embodiment of the smoking article of the present invention the filter comprises at least one first plug of non-wrap acetate filtration material. Non-wrap acetate filter plugs are particularly advantageous as they show an innate hardness and roundness compared to standard cellulose acetate filter plugs, which is conferred by steam hardening the outer surface of the acetate plug during filter making. Thereby use of a thick filter wrapper is not necessary to provide increased filter rigidity.

[0058] Where at least one non-wrap acetate filter plug is used it is further advantageous in another embodiment of the invention to provide the filter with at least one second plug of non-wrap acetate filtration material, the first and second plugs of non-wrap acetate filtration material being over-wrapped by a single filter wrapper holding both first and second plugs in a spaced relationship to define a cavity there between. Using two non-wrap acetate filtration material plug is particularly advantageous as it allows formation of cavity filters having a single filter wrapper of relatively low basis weight as proposed by the invention while still providing increased rigidity, where usually multi-plug filters require two or more filter wrapper layers.

[0059] In one embodiment, the filter of the smoking article of the invention comprises at least one fluid-releasing member positioned in the cavity, preferably a breakable capsule containing an oil- or water-based liquid.

[0060] In an embodiment, particularly when the filter comprises a fluid-releasing member, the one or more filter wrappers comprises a waterproof non-porous wrapper.

[0061] The length of the filter (which is the total length of the filter, including the plug of filtration material, measured in a direction substantially parallel to the longitudinal axis of the smoking article) may have any suitable value. However, it may be convenient for the filter length to be substantially the same as in conventional smoking articles. Therefore, the smoking article may comprise a filter with a length of between about 20 mm to 30 mm.

[0062] The circumference of the filter (which is the total circumference of the plug of filtration material together with the tipping material and the one or more filter wrappers) may have any suitable value. However, it may be convenient for the diameter to be substantially the same as in conventional smoking articles.

[0063] The filter may have, at any part thereof, a circumference of between about 20 mm to about 25 mm, i.e. a diameter between about 6.4 mm and about 8.0 mm, where the diameter of the smoking article is the total diameter of the plug of filtration material together with the tipping material and the one or more filter wrappers, measured in a direction substantially perpendicular to the longitudinal axis of the smoking article.

[0064] The filter may have a pressure drop, or resistance to draw, of between about 20 mmWC and about 140 mmWC, such as of between about 40 mmWC and about 120 mmWC, such as of between about 50 mmWC and about 100 mmWC, for example, of about 70 mmWC.

[0065] The tobacco rod may comprise any suitable type or types of tobacco material or tobacco substitute, in any suitable form. The tobacco can be a single type of tobacco or a blend of two or more types of tobacco. The tobacco may be in the form of cut filler (cut and conditioned tobacco). The tobacco rod is wrapped in a combustible wrapper, usually cigarette paper.

[0066] According to a second aspect, the invention relates to a filter for a smoking article. The filter comprises at least one plug of filtration material wrapped with one or more filter wrappers, where the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre. The at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10%. The plasticizer content may be of between about 7% and 10%, such as of between about 7% and 9%, such as of between about 6% and 8%, for example of about 8%.

[0067] Advantageously, the inventors have found that hardness values of below 90% can be achieved by using merely plug wrappers having a basis weight of more than 32 grams per square metre and less than 50 grams per square metre for the plug(s) of filtration material in the filter without increasing the content of plasticizer used in the filtration material, while offering easy machinability of the plug wrappers during manufacturing of the smoking articles, thereby not increasing the machine costs, and further allowing easy online laser perforation of the filter, what requires extreme care and powerful lasers when plug wrappers having a basis weight of 50 grams per square metre and

higher are used. In an embodiment of the invention, the hardness of the filter measured at any point of the filter is less than about 90% but higher than about 85%, for example in the range of between 86% and 88%.

[0068] The one or more filter wrappers may comprise any suitable material or combination of materials as already described with regard to the first aspect of the invention. Examples of suitable materials include, but are not limited to, cellulose based materials, cellulose based film, cardboard, paper, recon, and combinations thereof. According to certain embodiments, the one or more filter wrappers comprise paper.

[0069] In an embodiment of the invention, one or more filter wrappers have a basis weight of between about 38 and about 49 grams per square metre, such as of between about 42 and about 48 grams per square metre, for example of about 45 grams per square metre.

[0070] The one or more filter wrappers may have a thickness of between about 50 to about 60 microns, for example of about 55 microns. Such range of thickness for the filter wrapper(s) of the filter further eases machinability of the filter and additionally contributes to provide a proper roundness of the filter.

[0071] The one or more filter wrappers of the filter may be non-porous wrappers.

[0072] The filtration material may comprise any suitable material or combination of materials as already described with regard to the first aspect of the invention. The type of filtration material may be selected to provide the desired hardness. Examples of suitable materials include, but are not limited to, cellulose acetate, cellulose, reconstituted cellulose, polylactic acid, polyvinyl alcohol, nylon, polyhydroxybutyrate, thermoplastic material, such as starch, non-woven materials, longitudinally oriented fibres and randomly oriented fibres, paper, crepe, PLA fibres, and combinations thereof. All or part of the filter may include activated carbon or other sorbent material. The filter may include an adhesive or plasticizer or a combination thereof. According to certain embodiments, the filtration material comprises cellulose acetate.

[0073] The filtration material may have any suitable denier per filament (dpf) and total denier (td). In certain embodiments, the filtration material has a denier per filament (dpf) of between 1.5 to 6.0, such as 2.0 to 5.0, such as 3.0 to 5.0, for example of about 3.8. The filter segment may have a total denier of less than about 40,000, such as less than about 38,000, such as less than about 35,000, such as less than about 33,000, for example of about 30,000.

[0074] In an embodiment where the filter has a length of between about 20 mm to 30 mm and a circumference of between about 20 mm to about 25 mm, the filter may have a tow weight in the range from about 90 mg to about 160 mg, such as in the range from about 100 mg to about 150 mg, such as in the range from about 120 mg to about 140 mg, such as in the range from about 130 mg to about 138 mg, for example of about 136.25 mg. The at least one plug of filtration material forming the filter may have a plasticizer content of between about 7% and 10% per weight of filtration material, more preferably about 8%. According to certain embodiments, as plasticizer triacetin is used.

[0075] In an embodiment, the filtration material comprises cellulose acetate, having triacetin as plasticizer, and the one or more filter wrappers comprise paper.

[0076] The perforations may extend through the filter wrapper or wrappers surrounding the plug of filtration material. Alternatively, the filter wrapper or wrappers may be porous.

[0077] In one embodiment the filter comprises a single plug of filtration material wrapped with a single filter wrapper. In such embodiment the plug of filtration material may extend along the whole length of the filter.

[0078] In a further embodiment of the smoking article of the present invention the filter comprises at least one first plug of non-wrap acetate filtration material. Non-wrap acetate filter plugs are particularly advantageous as they show an innate hardness and roundness compared to standard cellulose acetate filter plugs, which is conferred by steam hardening the outer surface of the acetate plug during filter making. Thereby use of a thick filter wrapper is not necessary to provide increased filter rigidity.

[0079] Where at least one non-wrap acetate filter plug is used it is further advantageous in another embodiment of the invention to provide the filter with at least one second plug of non-wrap acetate filtration material, the first and second plugs of non-wrap acetate filtration material being over-wrapped by a single filter wrapper holding both first and second plugs in a spaced relationship to define a cavity there between. Using two non-wrap acetate filtration material plug is particularly advantageous as it allows formation of cavity filters having a single filter wrapper of relatively low basis weight as proposed by the invention while still providing increased rigidity, where usually multi-plug filters require two or more filter wrapper layers.

[0080] In one embodiment, the filter of the smoking article of the invention comprises at least one fluid-releasing member positioned in the cavity, preferably a breakable capsule containing an oil- or water-based liquid.

[0081] In an embodiment, particularly when the filter comprises a fluid-releasing member, the one or more filter wrappers comprises a waterproof non-porous wrapper.

[0082] The filter may have a pressure drop, or resistance to draw, of between about 20 mmWC and about 140 mmWC, such as of between about 40 mmWC and about 120 mmWC, such as of between about 50 mmWC and about 100 mmWC, for example of about 70 mmWC.

[0083] According to a third aspect the invention relates to the use of the filter according to the second aspect of the invention in a smoking article.

EXAMPLES

[0084] The present invention will now be described with reference to examples thereof, without limiting the scope of the invention to these particular examples.

[0085] The hardness of various types of smoking article was tested using a known DD60A Densimeter (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany) device, which was fitted with a measuring head for cigarettes and with a cigarette receptacle, as described above. The samples were tested by following the method which is recommended for the known DD60A Densimeter device (manufactured and made commercially available by Heinr. Borgwaldt GmbH, Germany). That is, a sample of smoking articles were held in parallel alignment, and subjected to an overall load of 2 kg, for a period of 20 seconds, and the diameters of the smoking articles before and after compression were recorded. The depression was used to determine the hardness (%) of each smoking article.

The apparatus for testing the hardness of the smoking articles filters is shown in FIGS. 2, 3 and 6.

[0086] FIG. 2 is a perspective view of an apparatus 4, such as a DD60A Densimeter device, for determining the hardness of a filter of a smoking article. The apparatus includes two parallel load applying rods 24 positioned over a support plate 30. The support plate 30 includes two parallel, spaced apart walls 12, with each wall 12 having ten equally spaced recesses. The recesses are arranged to prevent the smoking articles 10 from contacting one another during testing.

[0087] As can be seen in FIG. 2, ten identically designed smoking articles 10 are aligned parallel in a plane, and placed on underlying cylindrical rods 14. The smoking articles 10 extend between corresponding recesses in the walls 12 to hold the smoking articles in place. The underlying cylindrical rods 14 extend parallel to the walls 12. Each smoking article 10 contacts the underlying rods 14 at two points, making for twenty total points of contact between the smoking articles to be tested and the underlying rods 14.

[0088] To test the hardness of a smoking article's filter, the smoking articles should be positioned such that the portion of the filter to be tested is in contact with the underlying rods 14. If filter is too short and the portion of the filter to be tested either does not contact both rods or contacts the rods very close to the ends of the portion of the filter to be tested, then it would be appreciated that this could be achieved by using twenty cigarettes in a back-to-back configuration, such as that shown in FIG. 3.

[0089] As shown, the concept of the DD60A Test is that the underlying cylindrical rods contact the sample material to be tested at twenty contact points. If the filter is sufficiently long to extend across the underlying rods, then the twenty contact points can be provided with ten samples (as shown in FIG. 2). If the filter is not sufficiently long, then the twenty contact points can be provided with twenty samples, as shown in FIG. 3.

[0090] As can be seen in FIG. 3, portions of the tobacco rods have been removed from each smoking article 10, and the filter portion of each smoking article 10 rests on a respective cylindrical rod 14. In the present case, the hardness of the mouth end segment is being tested, and therefore it is this portion of the filter which rests on the rod 14, and

the mouth end segment is approximately centered on the rods 14. If the filter comprises a single plug of filtration material, the filter is approximately centered on the rods 14, e.g. if a filter with a length of 24 mm is used the rod 14 is applied at a position located about 12 mm from the mouth end of the filter. If a filter comprising two plugs of filtration material is used the filter is located on the rod 14 in such a way that at least one of the plugs is centered on the rod 14, and in particular the rod 14 is not located at a position between the two plugs of filtration material. If necessary, the tips of the smoking articles extending away from the cylindrical rods 14 may be supported by an underlying supporting means to prevent pivoting of the smoking articles.

[0091] The apparatus is shown in FIG. 3 in a first configuration, in which the two load applying cylindrical rods 24 are raised above and out of contact from the smoking articles 10. To test the hardness of the smoking articles, the load applying cylindrical rods 24 are lowered to a second configuration, to come into contact with the smoking articles 10, as shown in FIG. 4. When in contact with the smoking articles 10, the load applying rods 24 impart an overall load of 2 kg across the twenty contact points of the smoking articles 10 for a duration of 20 seconds. After 20 seconds have elapsed (and with the load still being applied to the smoking articles), the depression in the load applying cylindrical rods 24 across the smoking articles is determined, and then used to calculate the hardness.

[0092] Five example filter cigarettes have been tested using the above described method and apparatus. All of them have a filter cigarette length of 84 mm and comprise a monoacetate filter, having a length of 27 mm and a circumference of 24.2 mm. In all cases the filtration material used is cellulose acetate, having a total denier of 30,000 and a plasticizer content of 8.0 wt %, where triacetin was used as plasticizer. The filtration material was wrapped by a non-porous filter wrapper, and the filter was attached in end-to-end relationship to a 57 mm tobacco rod by a non-porous tipping paper, having a basis weight of 31 g/m². Different non-porous filter wrappers were tested with a varying basis weight and a varying thickness. Other differences between the filter cigarettes were denier per filament, tow weight, pressure drop and tipping paper thickness. The table below summarizes the example cigarettes and provides measured hardness values.

	Example 1	Example 2	Example 3	Example 4	Example 5
Cigarette length	84 mm	84 mm	84 mm	84 mm	84 mm
Tobacco rod length	57 mm	57 mm	57 mm	57 mm	57 mm
Filter length	27 mm	27 mm	27 mm	27 mm	27 mm
Filter circumference	24.2 mm	24.2 mm	24.2 mm	24.2 mm	24.2 mm
Denier per filament	3.80	3.0	3.80	3.80	3.80
Total denier	30,000	30,000	30,000	30,000	30,000
Tow weight	136.25 mg	131.25 mg	126.5 mg	136.25 mg	135.75 mg
Pressure drop	70 mmWC	80 mmWC	60 mmWC	60 mmWC	60 mmWC
Plasticizer content	8.0 wt %	8.0 wt %	8.0 wt %	8.0 wt %	8.0 wt %
Filter wrapper basis weight	45 g/m ²	45 g/m ²	45 g/m ²	35 g/m ²	39 g/m ²
Filter wrapper thickness	55 μm	55 μm	55 μm	55 μm	60 μm
Tipping paper basis weight	31 g/m ²	31 g/m ²	31 g/m ²	31 g/m ²	31 g/m ²
Tipping paper thickness	36 μm	36 μm	36 μm	35 μm	35 μm
Filter hardness	89.0%	89.4%	85.8%	89.3%	89.7%

1. A smoking article comprising:
 - a tobacco rod;
 - a filter comprising at least one plug of filtration material wrapped with one or more filter wrappers; and
 - a tipping material attaching the tobacco rod and the filter; wherein the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre, and the at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and about 10%.
2. A smoking article according to claim 1, wherein a hardness of the smoking article measured at any point of the filter when attached to the tobacco rod by the tipping material is less than about 90%.
3. A smoking article according to claim 1, wherein a hardness of the smoking article measured at any point of the filter when attached to the tobacco rod by the tipping material is higher than about 85%.
4. A smoking article according to claim 1, wherein the basis weight is between about 42 and 48 grams per square metre.
5. A smoking article according to claim 1, wherein the one or more filter wrappers are non-porous wrappers.
6. A smoking article according to claim 1, wherein the one or more filter wrappers have a thickness of between about 50 to 60 microns.
7. A smoking article according to claim 1, wherein the one or more filter wrappers is a single filter wrapper, and the at least one plug of filtration material is a single plug of filtration material wrapped with the single filter wrappers.
8. A smoking article according to claim 1, wherein the one or more filter wrappers is a single filter wrapper, and the at least one plug of filtration material further includes at least one first plug of non-wrap acetate filtration material and at least one second plug of non-wrap acetate filtration material, the first and second plugs of non-wrap acetate filtration material being overwrapped by the single filter wrapper holding both first and second plugs in a spaced relationship to define a cavity there between.
9. A smoking article according to claim 8, wherein the filter comprises at least one fluid-releasing member positioned in the cavity.
10. A smoking article according to claim 1, wherein the one or more filter wrappers comprises a waterproof non porous wrapper.
11. A smoking article according to claim 1, wherein the filter has a length of between about 20 mm to 30 mm.
12. A smoking article according to claim 1, wherein the filter has, at any part thereof, a circumference of between about 20 mm to about 25 mm.
13. A smoking article according to claim 11, wherein the filter has a tow weight in the range from about 90 mg to about 160 mg.
14. A filter for a smoking article, the filter comprising:
 - at least one plug of filtration material wrapped with one or more filter wrappers;
 - wherein the one or more filter wrappers have a basis weight of more than 32 grams per square metre and less than 50 grams per square metre, and the at least one plug of filtration material forming the filter has a plasticizer content of between about 5% and 10%.
15. Use of the filter according to claim 14 in a smoking article.

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