



PATENT SPECIFICATION

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COMPLETE SPECIFICATION

FILTER TIPS FOR CIGARETTES AND LIKE TOBACCO ARTICLES Improvements in Tobacco Smoke Filter Element

like tobacco articles
when said articles are smoked

5 We, THE AMERICAN TOBACCO COMPANY, a corporation organized and existing under the laws of the State of New Jersey, United States of America, of 150, East 42nd Street, New York, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 tips/ This invention relates to filter elements for cigarettes and the like and, more particularly, to a filter element which not only removes undesirable constituents from tobacco smoke, but also introduces a flavoring agent into the smoke.

15 It is common practice to add flavoring agents to tobacco, generally by adding these agents directly to the tobacco. In some instances, such as with menthol, the heat of combustion of the tobacco causes decomposition of the flavoring agent with resulting formation of by-products which are noticeably detrimental to the flavor of the tobacco smoke. Also in the case of highly volatile flavoring agents typified by menthol, there is a tendency for the flavoring agent to volatilize and be lost before the tobacco is used. Accordingly, there have been proposals, such as in Allen's United States Patent No. 2,063,014 issued December 8, 1936, to adsorb the volatile flavoring agent on an adsorptive material such as carbon black or silica and then incorporate the thus-treated adsorptive material throughout the tobacco. Although this expedient helps to retain the flavoring agent in the tobacco until smoked, the agent is nevertheless subjected to the destructive effect of the heat of combustion of the burning tobacco.

40 An alternative procedure for adding a flavoring agent to tobacco smoke is that described in Paffgen's French Patent No. 685,864, dated November 30, 1929, wherein [Price 4s. 6d.]

an ethereal oil is absorbed in a mass of absorptive material such as carbon black or silica gel. By loading the absorptive material with the ethereal oil, the thus-treated mass of absorptive material can be used as a filter element which will absorb nitrogenous nicotinic constituents in the tobacco smoke. The absorbed nicotinic constituents replace some of the absorbed ethereal oil in the filter element and thus release the ethereal oil vapors into the smoke leaving the filter. However, as explained in the patent, the loading of the absorptive material with the ethereal oil prevents the material from filtering out any of the other volatile constituents of the smoke.

We have now discovered that by using such materials as activated carbon and silica as adsorbents, rather than as absorbents, of a volatile flavoring agent for tobacco smoke, the adsorbed flavoring agent, when made a component of a filter element, is selectively and progressively eluted by the particulate matter in the smoke and not by the nicotinic constituents of the smoke, with the result that the flavoring agent is released in proportion to the amount of smoke passing through the filter element and that the undesirable volatile constituents of the smoke are adsorbed by the adsorptive material in the same manner as if the volatile flavoring agent were not present in the adsorptive material.

The adsorptive material is made to function as such by dispersing it throughout a carrier base rather than as an absorptive mass of the material pursuant to the aforementioned French patent No. 685,864. When the volatile smoke-flavoring agent, such for example as menthol, has been adsorbed pursuant to our invention and all excess flavoring agent has been removed, the adsorbed flavoring agent is held so effectively by the adsorptive material that there is no significant release of the flavoring agent from the adsorptive

1 tip for a cigarette or like tobacco article

material, by volatilization or otherwise, during extensive period of storage. Thus, a filter element of our invention containing adsorbed menthol does not evidence the characteristic odor of the flavoring agent.

The elution of the volatile smoke-flavoring agent from the adsorptive material when used as a tobacco smoke filter element pursuant to our invention appears to be effected by the particulate matter in the smoke. This particulate matter consists to a large extent of minute droplets of semi-liquid material. When any of these droplets come into contact with the adsorptive material in our filter element, they are adsorbed and the resulting heat of adsorption, supplemented by the heat of adsorption of vapor phase constituents by the same adsorptive material in our filter element, causes a significant amount of vaporization of the adsorbed flavoring agent. The thus-released vapor of the flavoring agent is then free to be adsorbed or absorbed by the particulate matter which has not been retained in the filter element, with the result that the particulate matter of the smoke which is drawn from the filter element contains the flavoring agent initially adsorbed by the adsorptive material of each filter element. This mechanism, to the best of our present understanding, explains why, with the use of the filter element of our invention, the volatile flavoring agent is eluted from the adsorptive material in an amount which appears to be a function of the amount of particulate material in the smoke drawn through the filter element. Thus, the filtered smoke contains a uniform amount of the flavoring agent and hence possesses a uniform taste throughout the entire smoking life of the cigarette. We have found no evidence of elution of the flavoring agent from the adsorptive material by nicotine in the smoke, and therefore the effectiveness of our filtering element in imparting the desired flavor to the smoke does not depend upon the nicotine content of the smoke or on the ability of the flavoring agent-treated adsorptive material to remove nicotine from the smoke.

Accordingly, our novel filter element for tobacco smoke comprises a carrier base in which there is substantially uniformly dispersed a finely divided adsorptive material having adsorbed thereon a volatile smoke-flavoring agent capable of being selectively eluted from the adsorptive material by the tobacco smoke.

The adsorptive material used in practicing our invention may be any finely divided solid material which acts as an adsorbent. Activated carbon and charcoal, obtained from a petroleum base or from coconut shells, pecan hulls, wood, or the like, silica gel, zeolites and chabazites are examples of such useful materials. Of the known adsorptive materials, we presently prefer to use activated carbon because of its outstanding capacity for

adsorbing volatile smoke-flavoring agents. All of these adsorptive materials are also capable of removing from tobacco smoke such volatile constituents as acetaldehyde, isoprene, acrolein, acetone, methyl alcohol, methyl furan, furan, isobutyraldehyde, methyl acetate, and the like.

The volatile smoke-flavoring agent comprises any one or more of those conventionally used for the purpose of flavoring tobacco smoke and include, for example, menthol, vanillin, benzaldehyde, spearmint oil, peppermint oil, oil of cloves, cardamon oil and ethyl valerate. In the case of a composite flavoring agent which is normally composed of a mixture of compounds, as in the case of spearmint oil, we have found that the elution of the flavoring agent from the adsorptive material favors the release of the more volatile compounds and, therefore, of the more characteristic flavor of the agent. The result is a fresher and cleaner taste than when all of the compounds in such a composite flavoring agent are volatilized from the adsorptive material.

Adsorption of the flavoring agent is effected by any of the conventional adsorption techniques. For example, adsorption is advantageously effected from a highly saturated solution of the flavoring agent in its solvent. The degree of saturation of this solution can be enhanced by the use of solvent pairs; for example, we have found it advantageous to effect adsorption of menthol on activated carbon by forming a substantially saturated solution of the menthol in ethyl alcohol containing from 5 to 50% by volume of water, the water content of the solvent mixture limiting the solvent capacity of the alcohol for the menthol, and by then adding the carbon to the menthol solution for a period of time sufficient to obtain adsorption of the menthol by the carbon. However, adsorption of the flavoring agent by the adsorptive material is also effectively accomplished by exposing the adsorptive material to vapors of the flavoring agent or to the pure flavoring agent in liquid form. Although adsorption of the flavoring agent by any of the foregoing procedures can be effected after the adsorptive material has been dispersed in the carrier base, we have found that most satisfactory results are obtained by effecting the adsorption before incorporating the adsorptive material in the carrier base.

The carrier base useful in practicing our invention comprises any of the materials conventionally used as filter elements for tobacco smoke. In general, these materials are cellulosic or polymeric and are in the form of sheet, filament or sponge-like mass, and include shredded or finely-cut tobacco itself. The adsorptive material is incorporated in or coated on these carrier bases, advantageously as uniformly as possible, in such manner as to retain their adsorptive characteristic. For

cigarettes and like tobacco articles

materials

example, activated carbon can be distributed in a sheet of cellulosic fibrous material as described in British Patent Specification 764,470. According to the procedure of this patent, activated charcoal is added to a so-called high alpha cellulose pulp of commerce, and the resulting mixture is formed into a sheet by conventional papermaking processes and equipment. The sheet is then crumpled or "worked" in order to form a mass of the charcoal-containing cellulosic material suitable as the filter element for tobacco smoke. Alternatively, a sheet or shreds of such fibrous material, without adsorptive material distributed therethrough, can be appropriately impregnated with the adsorbent by immersing the sheet or shreds in, or spraying it with, a slurry of the adsorbent. Suitable adsorbent-containing base materials can also be prepared by brushing or dusting the adsorbent on the carrier base, either with or without the use of a carrier base additive which enhances its retention of the adsorptive material. Whatever the form and composition of the carrier base with its contained adsorptive material, it is made into a filter element by any conventional technique appropriate to the form and composition of the base material.

Control of the amount of flavoring agent imparted to the tobacco smoke may be effected by several expedients. For example, the various adsorbent materials mentioned heretofore have different capacities for adsorbing the flavoring agent, and hence the amount of adsorbed flavoring agent available for transfer to the smoke can be controlled by the choice of adsorbent material. Moreover, the various adsorbent materials have different capacities for adsorbing particulate matter and volatile constituents from the smoke, with the result that different amounts of heat of adsorption are generated with attendant variation in the rate at which the flavoring agent is volatilized for incorporation in the smoke. In addition, the amount of any adsorptive material dispersed in the carrier base can be varied, or the length of the filter element containing the flavoring agent-treated adsorptive material can be varied, so as to alter the amount of flavoring agent transferred to the smoke as it passes through the filter element. By increasing the density of the filter element to increase the pressure drop as smoke is drawn through it, the resulting decrease in the amount of smoke through the filter increases the extent of adsorption of particulate matter by the adsorptive material, but although this may result in the generation of more heat of adsorption with attendant increase in volatilization of the flavoring agent there is also less particulate matter passing out of the filter and hence less flavoring agent carried from the filter. Further control over the amount of flavoring agent-containing particulate matter reaching the smoker's mouth can

be obtained by adding a mechanical filter element, such as a cellulosic plug, to the cigarette adjacent the discharge end of the flavoring filter element of our invention.

The amount of adsorbed flavoring agent which should be available for transfer to the tobacco smoke will vary with the amount of tobacco in the cigarette and upon the flavoring strength of the agent. In general, we have found that the amount of flavoring agent-treated adsorptive material just sufficient to impart the desired flavor to the smoke throughout the smoking life of a cigarette is less than that amount of adsorptive material required for removal of the adsorbable volatile constituents present in the smoke from the cigarette. Accordingly, if a greater degree of adsorption of these volatile constituents is desired, the filter element of our invention can be supplemented with an additional component composed of untreated adsorptive material in order to obtain the required amount of reduction in concentration of volatile constituents without wasting excess flavoring agent.

EXAMPLE I.

The following specific example is illustrative of the production of a filter element of our invention using menthol as the smoke-flavoring agent and activated carbon as the adsorptive material. One pound of menthol was dissolved in 1.4 gallons of a 50-50 (by volume) mixture of ethyl alcohol and water. The resulting solution was substantially completely saturated with respect to the menthol. One pound of petroleum base activated carbon was ground to a size such that a major portion of it passed through a 200 mesh (Tyler Standard) screen and a significant portion passed through a 325 mesh screen. The ground carbon was then added to the menthol solution and the resulting mixture was agitated at room temperature for two hours. The carbon with its adsorbed menthol was separated by filtration and was washed three times with 20% by volume alcohol (balance water). The washed carbon was thereafter dried for 20 minutes in an oven maintained at 220° F. The resulting product consisted of activated carbon containing adsorbed menthol. This carbon product was then dispersed in a cellulosic carrier base by adding it to an aqueous pulp of high alpha cellulose in the amount of about 25 parts by weight of carbon to 75 parts of the pulp on a solids basis. After thorough mixing of the charcoal and pulp in the furnish, the pulp was formed by conventional papermaking technique into paper sheet weighing about 16 grams per square meter. The paper was crumpled and formed into a filter element by the procedure described in the aforementioned British Patent Specification 764,470. The resulting filter element comprised a cellulosic carrier base having dispersed therein activated

carbon containing adsorbed menthol. When incorporated in a filter cigarette, the representative filter element of our invention imparted 0.2—0.3 milligram of menthol to the smoke of the cigarette when smoked according to generally accepted smoking procedure, that is, smoking 47 millimeters of the cigarette and taking one puff per minute each of two seconds duration and of 35 milliliters volume. In general, we have found that similar filter elements impart from 0.2 to 0.6 milli-

gram of menthol to the smoke of each cigarette when tested according to this procedure.

The following examples illustrate the effect on the menthol content of the smoke when the length of the filter element of our invention is varied. In each example, the total length of filter is maintained constant, in order to maintain a uniform amount of filtered smoke, by adding to our filter element an additional plug composed of cellulose acetate filaments:

Example	Menthol treated Charcoal Plug, Length/mm	Cellulose Acetate Plug Length/mm.	Menthol content of smoke Mg/Cigarette
II	4	11	0.28
III	5	10	0.36
IV	6	9	0.44
V	7—1/2	7—1/2	0.47
VI	10	5	0.53

Although we have referred previously herein to the use of volatile smoke-flavoring agents in the smoke filter element of our invention, it will be readily appreciated that the volatile agent adsorbed by the adsorptive material may comprise any inhalant having beneficial properties. Accordingly, the term "volatile smoke-flavoring agent" as used herein and in the claims must be understood to include any volatile substance the inhalation of which enhances the smoke or is otherwise beneficial to the smoker.

WHAT WE CLAIM IS:—

1. A filter element capable of adsorbing the undesirable volatile constituents of tobacco smoke which comprises a carrier base in which there is substantially uniformly dispersed a finely divided adsorptive material having adsorbed thereon a volatile smoke-flavoring agent capable of being selectively eluted from the adsorptive material in proportion to the amount of tobacco smoke passing through the filter element, the adsorptive material being substantially free of smoke-flavoring agent other than that which is adsorbed thereon whereby there is no significant release of the flavoring agent from the adsorptive material by volatilization during storage.

2. A filter element according to claim 1 in which the carrier base is cellulosic.

3. A filter element according to claim 1 in which the carrier base is paper.

4. A filter element according to any of the preceding claims in which the adsorptive

material is activated carbon.

5. A filter element according to any of the preceding claims in which the volatile smoke-flavoring agent is menthol.

6. The method of producing a tobacco smoke filter containing a volatile smoke flavoring agent characterized in that the volatile smoke flavoring agent is incorporated in the filter by first effecting adsorption of the volatile smoke flavoring agent on finely divided particles of an adsorptive material, then forming a slurry of the resulting particles of adsorptive material in a liquid medium compatible with the retention of adsorbed flavoring agent on the adsorptive material, effecting contact between said slurry and a carrier base in order to incorporate the adsorptive material in dispersed form throughout the carrier base, and drying the thus impregnated carrier base to remove the liquid slurring medium and any excess flavoring agent beyond that which is adsorbed by the adsorptive material.

7. The method according to claim 6 characterized in that the finely adsorptive material is activated carbon, in that the carrier base is paper and in that the flavoring agent is menthol.

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Crui Shank & Fairweather

tip for a cigarette or like tobacco article

when said article is smoked

tip/

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tip/

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tip/

tip/

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carbon containing adsorbed menthol. When incorporated in a filter cigarette, the representative filter ~~element~~ of our invention imparted 0.2—0.3 milligram of menthol to the smoke of the cigarette when smoked according to generally accepted smoking procedure, that is, smoking 47 millimeters of the cigarette and taking one puff per minute each of two seconds duration and of 35 milliliters volume. In general, we have found that similar filter elements impart from 0.2 to 0.6 milli-

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WHAT WE CLAIM IS:—

1. A filter ~~element~~ capable of adsorbing the undesirable volatile constituents of tobacco smoke which comprises a carrier base in which there is substantially uniformly dispersed a finely divided adsorptive material having adsorbed thereon a volatile smoke-flavoring agent capable of being selectively eluted from the adsorptive material in proportion to the amount of tobacco smoke passing through the filter ~~element~~, the adsorptive material being substantially free of smoke-flavoring agent other than that which is adsorbed thereon whereby there is no significant release of the flavoring agent from the adsorptive material by volatilization during storage.

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