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TOBACCO-SMOKE FILTERS

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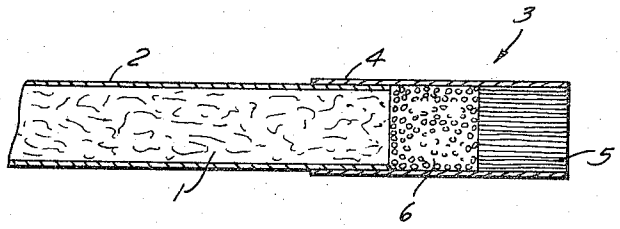
FIG.1



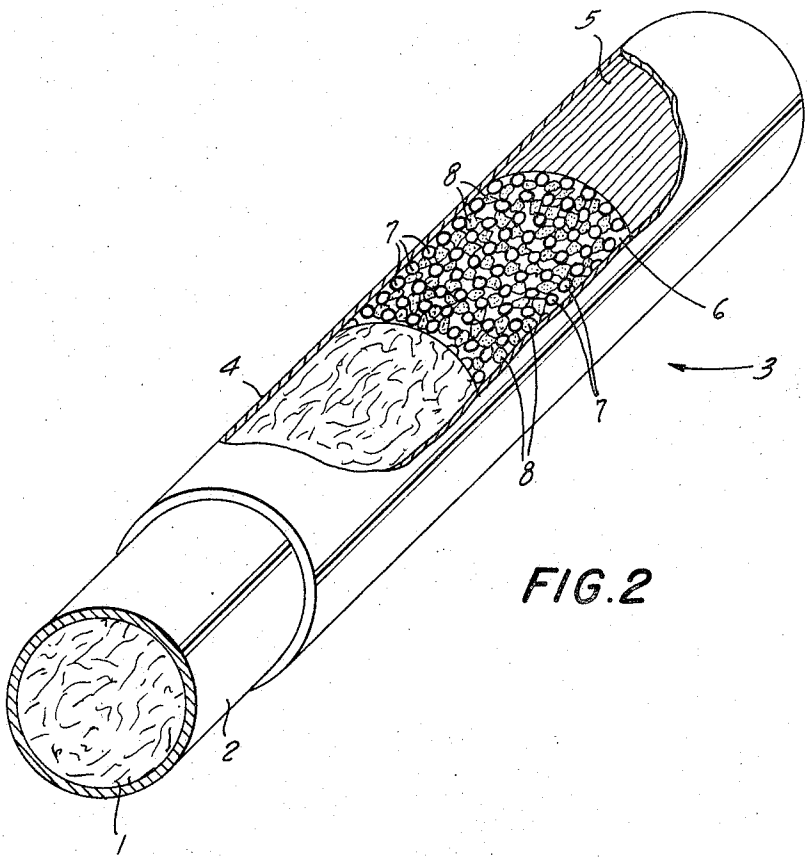


FIG.2

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TOBACCO-SMOKE FILTERS

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13 Claims. (Cl. 131—267)

ABSTRACT OF THE DISCLOSURE

A tobacco smoke filter in the form of a bonded, porous, self-sustaining rod comprising a mixture of powdered or granular absorbent material and particulate low melting bonding material such as simple or complex hydrated salts of inorganic acids or metallic salts of organic acids with the bonding material having a melting point not in excess of 250° C. and the particle size of bonding material being at least substantially equal to the particle size of the filter material, and method of making same.

This invention concerns improvements relating to tobacco-smoke filters. The use of granular or powdered materials as components of cigarette filters is already known, but their incorporation in such a manner as to give even distribution and to avoid losses during manufacture and use presents difficulties. Proposals intended to avoid these difficulties, for example distribution of the granular or powdered material within a fibrous mass or sheet of another filtering material or its enclosure in a cartridge or between filter plugs or between a plug and the tobacco rod, have met with only limited success. Attainment of even distribution may entail an undesirably slow rate of production and difficulty may be encountered in maintaining the content of material reasonably constant from one filter-tip to another.

An object of the present invention is to make possible rapid and convenient continuous manufacture of filters comprising powdered or granular materials, with little or no risk of losses during manufacture or subsequent use.

According to the invention, powdered or granular filter material for tobacco smoke is mixed with a powdered or granular, low melting, salt and the mixture is heated so that the filter material is bonded by the said salt. By a low-melting salt is meant one with a melting point below 250° C., but preferably with a melting point between 100° and 150° C.

In the accompanying drawing which illustrates the invention herein,

FIG. 1 is a longitudinal sectional view of a cigarette with the tobacco rod section broken away showing a typical filter construction; and

FIG. 2 is an enlarged perspective view partly broken away of the bonded filter section of FIG. 1.

FIG. 1 illustrates a typical cigarette having a tobacco rod section 1 enrobed in an outer paper wrapper 2. A filter assembly 3 is encased in an outer wrapper of tip material 4 with the tip material encircling the end portion of the enrobed cigarette rod so as to mount the filter assembly to the end thereof. The filter assembly includes a mouthpiece element 5 of fibrous material and interposed between tobacco rod section 1 and mouthpiece element 5 is bonded section 6.

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FIG. 2, which best illustrates bonded section 6, comprises particles of filter material 7 and particles of bonding material 8. The partially broken away section of FIG. 2 illustrates the manner in which particles of bonding material 8 contact particles of filter material 7 so as to effect a bond therebetween. Since the bonding material is a low melting material, the particles when heated are melted or softened sufficiently to contact the adjacent surfaces of the filter material. Then, when cooled, the low melting material will solidify to form a firmly bonded rod.

The filter material may be any adsorbent or absorbent material, with a desirable effect on tobacco smoke, which is available in powdered or granular form, for example charcoal, silica gel, zeolites, perlite, sepiolite, activated alumina, magnesium silicate, or mixtures thereof, or the like.

Suitable salts of inorganic acids include simple salts in a crystalline hydrated form such as trisodium orthophosphate, sodium perborate, calcium bromide, aluminium bromide, ferrous sulphate and cupric nitrate. More complex salts of inorganic acids may also be used in the crystalline hydrated form, such as sodium aluminium sulphate (soda alum), potassium aluminium sulphate (potash alum) and potassium chromium sulphate (potassium chrome alum). Suitable salts of organic acids include magnesium stearate, aluminium stearate and crystalline hydrated magnesium acetate. In addition to being effective bonding materials, several of these salts, notably hydrated trisodium orthophosphate and hydrated sodium perborate, have a desirable effect upon the properties of the smoke passed through the filter, whereby the effectiveness of the powdered or granular filter material is enhanced.

The particle size of the filter material may be chosen to provide a desired porosity of the resultant mass and may, suitably, be smaller than 10 mesh and larger than 80 mesh (British Standard Specification) per inch and is preferably between 20 and 50 mesh. Preferably, the bonding material has a particle size at least substantially the same as that of the filter material and is present in a proportion of between one part to three parts and equal parts, by weight, with respect to the filter material. Preferably between 25 and 50% of the total initial mixture consists of bonding material.

According to one manner of carrying the invention into effect, the bonding and filter materials, intimately mixed, are fed on to a band of paper passing beneath a feed hopper in which the level of the mixture is kept substantially constant. The band, which has a channel shape imparted by a guide, passes, just beyond the hopper, under a gate device which regulates the level of the material. Supported in a channel, the band then passes below electrical heaters extending lengthwise of the band and provided with reflectors which direct the rays normally to the said band. The heaters preheat the mixture to cause the bonding material to begin to soften. The preheated mixture passes on the band into a ring die by which the band is folded around the mixture to form a "rod".

This rod passes through electrically heated dies to complete the softening of the bonding material and to ensure firm bonding of the granules of the filter material to one another. The temperature in these dies should be such as to complete the said softening, while avoiding risk of impairing either of the materials. Each of the dies is of slightly larger circumference than the circumference required for the final rod. A hot-air stream may advan-

tageously be introduced into the dies to reduce frictional drag on the rod.

The enrobed and heated rod next passes to dies which are cooled by a circulated refrigerant, suitably of a halogenated hydrocarbon type. Provision is made for dried refrigerated air to be introduced to the outer surface of the rod by way of radially disposed small holes. This flow of air not only assists in setting the rod in the desired size with an effective joint between the edges of the band, but also acts as an air bearing and reduces the risk of condensation of atmospheric moisture. The circumference of the cool dies is slightly less than that of the heated dies and may be slightly larger than that of the final rod.

From the last die, the rod passes on to a conventional endless cigarette-machine tape which provides the traction for the movement of the band and rod through the apparatus and carries the rod through a guide or garniture to a conventional cut-off device which divides it into lengths for future processing into filter-tip cigarettes.

The above described method and apparatus are more fully described in the specification of U.S. patent application Ser. No. 449,255.

If required it may be arranged for the granular or powdered material to be bonded to the paper. In this case, in order to ensure firm such bonding, it is recommended that a polyethylene-coated paper should be used instead of a plain paper.

In some cases, further heating may be applied before the cutting operation, or after completion of the rods, to ensure complete bonding of the powder or granules of the filter material. Suitably, this heating may be effected by a dielectric heating device.

One manner of carrying the invention into effect will now be more fully described by way of example:

2 parts by weight of granules of activated charcoal (Sutcliffe Speakman, Grade 270C) of mesh size 20–50 (British Standard Specification) were mixed with one part of trisodium orthophosphate dodecahydrate crystals previous sieved through a screen of mesh size 10. The mixture was fed continuously from a constant-level hopper to a band of polyethylene-coated paper 27.5 mm. wide travelling at a rate of 23 feet per minute.

The mixture then passed on the band below three infrared heaters, was formed into a rod by a ring-die and passed immediately into a set of three dies 25 mm. in circumference heated to about 200° C. and supplied, inside the dies, with a hot air stream at a temperature of about 250° C.

The rod was immediately cooled to a temperature of about 0° C. in series of four cool dies, 24.8 mm. in circumference, into the interior of which dry refrigerated air was introduced through holes of 0.015 inch diameter at a pressure of 7–8 lbs./sq. in. A cut-off device cut the rod into 78 mm. lengths. Filters produced from the rod material were firmly bonded and even in packing had a circumference of 24.6 mm.

10 mm. sections of the rod lengths were cut and attached to cigarettes of 72 mm. length. The cigarettes were smoked to a 23 mm. butt using a smoking machine which gave a puff of 35 cc. volume and two seconds duration once per minute. Analysis of the smoke gave the following results:

Analysis of the material trapped by the filter, and of the smoke passing through the filter, showed a substantial reduction in the tar to nicotine ratio with a removal of more than 35% of acids and phenols, and a removal of more than 75% of the aldehydes, hydrogen cyanide an hydrogen sulphide present in the smoke.

We claim:

1. A method of producing a bonded, self-sustaining, porous tobacco smoke filter which comprises mixing particles of tobacco smoke filter material with particles of low melting bonding material selected from the group consisting of the hydrates of simple and complex crystalline metallic salts of inorganic acids and metallic salts of organic acids, the particle size of the bonding material being at least substantially equal to the particle size of filter material; feeding the mixture at a substantially constant rate onto a moving channel-shaped paper band; folding the paper band and mixture into a rod; heating the folded rod to a temperature not in excess of 250° C. to soften the low melting bonding maetrial contacts surfaces of the particles of filter material; and then cooling the heated rod to solidify the low melting bonding material to form a firmly bonded rod.

2. A method according to claim **1**, wherein the particle sizes of the two materials are between 20 and 50 mesh.

3. A method according to claim **1**, wherein the low-melting material constitutes 25 to 50% of the mixture.

4. A method according to claim **1**, wherein the low-melting material comprises hydrated trisodium orthophosphates and the filter material granular carbon particles.

5. A method according to claim **1** wherein the low-melting material is selected from the group consisting of trisodium orthophosphate, sodium perborate, calcium bromide, aluminum bromide, ferrous sulphate, cupric nitrate, sodium aluminum sulphate, potassium aluminum sulphate, potassium chromium sulphate, magnesium stearate, aluminum stearate and hydrated magnesium acetate.

6. A method of producing a bonded, self-sustaining, porous tobacco smoke filter which comprises mixing particles of activated charcoal tobacco smoke filter material with particles of trisodium orthophosphate dodecahydrate low melting bonding material, the particle size of the bonding material being at least substantially equal to the particle size of the filter material; feeding the mixture at a substantially constant rate onto a moving channel-shaped paper band; folding the paper band and mixture into a rod; heating the folded rod to a temperature not in excess of 250° C. to soften the low melting material so that the softened material contacts the surfaces of the particles of filter material and then cooling the heated rod to solidify the low melting material to form a firmly bonded rod.

7. The method as set forth in claim **6** wherein 2 parts by weight of activated charcoal is mixed with 1 part of trisodium orthophosphate dodecahydrate and the particle size of both materials is between 20 and 50 mesh.

8. A tobacco smoke filter comprising a bonded, porous, self-sustaining rod formed of a mixture of particles of a tobacco smoke filter material and a particulate low melting bonding material selected from the group consisting of the hydrates of simple and complex crystalline metallic salts of an inorganic acid and metallic salts of an organic acid, the bonding material having a melting point not in excess of 250° C.; the particle size of the bonding material being at least substantially equal to the particle size of the filter material so that the bonding material is in adhesive contact with surfaces of the filter material to form a tobacco smoke filter.

9. A filter means according to claim **8**, wherein the filter material comprises granular carbon particles and the low-melting material is hydrated trisodium orthophosphate.

10. A filter means according to claim **8** wherein the low-melting material is selected from the group consisting of trisodium orthophosphate, sodium perborate, calcium bromide, aluminum bromide, ferrous sulphate, cupric nitrate, sodium aluminum sulphate, potassium aluminum sulphate, potasssium chromium sulphate, magnesium stearate, aluminum stearate and hydrated magnesium acetate.

11. A filter means according to claim **8** wherein the low-melting material constitutes 25 to 50% of the mixture.

12. A tobacco smoke filter comprising a bonded, porous, self-sustaining rod formed from a mixture of particles of activated charcoal tobacco smoke filter material and particles of trisodium orthophosphate dodecahydrate low melting bonding material, the bonding material having a melting point no greater than 250° C.; the particle size of the bonding material being at least substantially equal to the particle size of the filter material.

13. A tobacco smoke filter as set forth in claim 12 wherein 2 parts by weight of activated charcoal is mixed with 1 part of trisodium orthophosphate dodecahydrate

and the particle size of both materials is between 20 and 50 mesh.

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