

[54] SMOKING ARTICLE

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[73] Assignee: R. J. Reynolds Tobacco Company, Winston-Salem, N.C.

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[51] Int. Cl.⁴ A24D 1/00; A24D 1/02; A24D 1/18; A24F 1/00

[52] U.S. Cl. 131/194; 131/335; 131/360; 131/361; 131/364; 128/202.21

[58] Field of Search 131/360, 361, 364, 359, 131/194, 335, 195, 196, 197

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Primary Examiner—V. Millin
Attorney, Agent, or Firm—Grover M. Myers; David G. Conlin

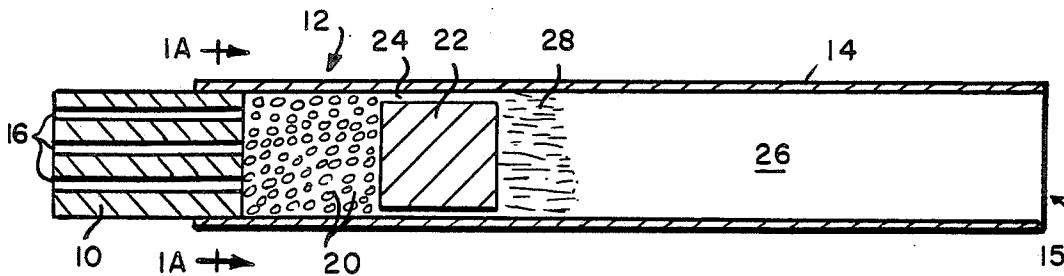
[57] ABSTRACT

The present invention relates to a smoking article which produces an aerosol that resembles tobacco smoke, but contains no more than a minimal amount of incomplete combustion or pyrolysis products.

The smoking article of the present invention provides an aerosol "smoke" which is chemically simple, consisting essentially of oxides of carbon, air, water, and the aerosol which carries any desired flavorants or other desired volatile materials, and trace amounts of other materials. The aerosol "smoke" has no significant mutagenic activity as measured by the Ames Test. In addition, the article may be made virtually ashless so that the user does not have to remove any ash during use.

One embodiment of the present smoking article comprises a short combustible carbonaceous fuel element; a short heat stable, preferably carbonaceous substrate bearing an aerosol forming substance, and a relatively long mouthend piece. The fuel element and the substrate are arranged in a heat exchange relationship, thereby causing aerosol formation without significant degradation of the aerosol former.

50 Claims, 3 Drawing Sheets



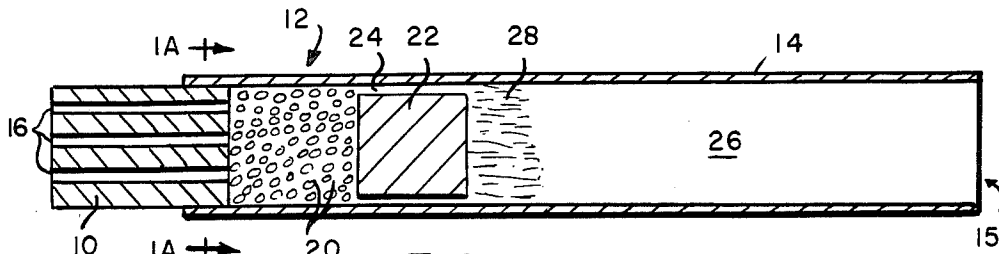


FIG. 1

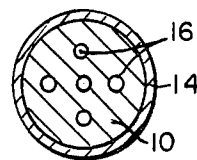


FIG. 1A

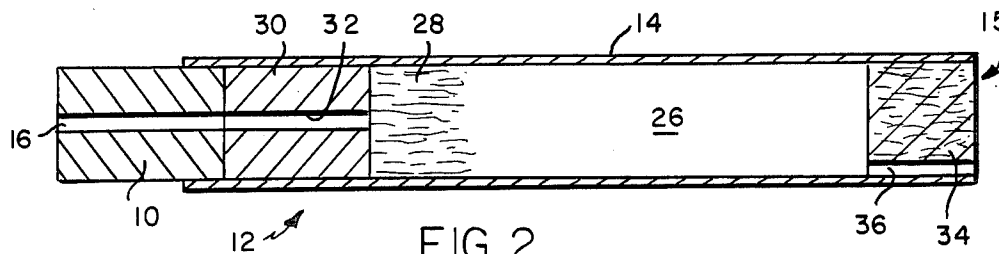


FIG. 2

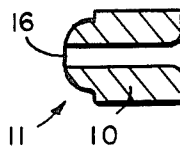


FIG. 2A

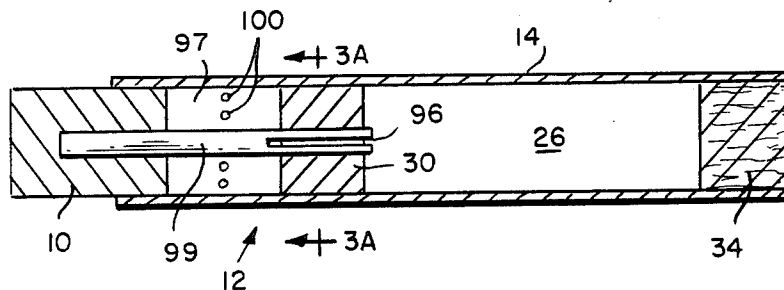


FIG. 3

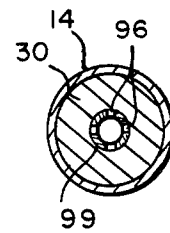


FIG. 3A

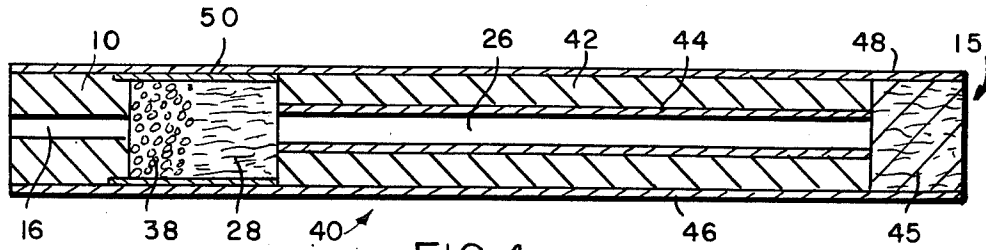


FIG. 4

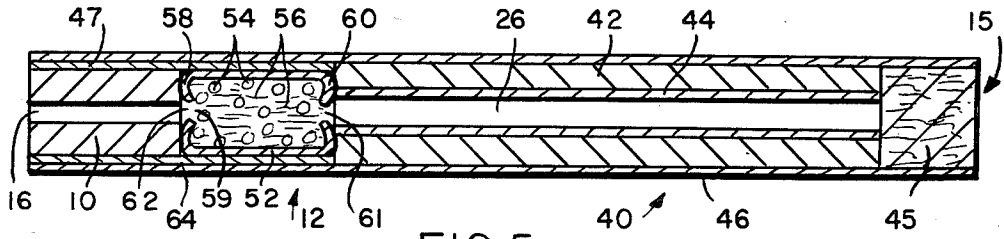


FIG. 5

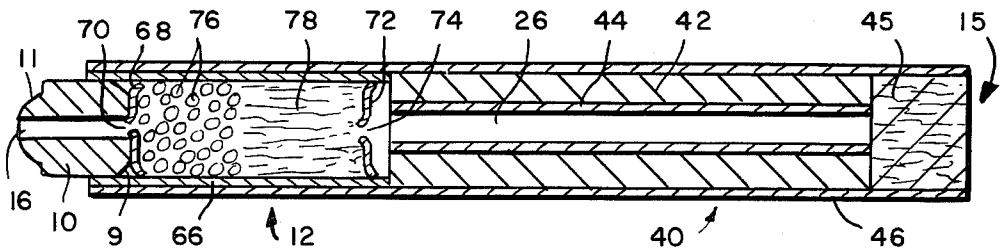


FIG. 6

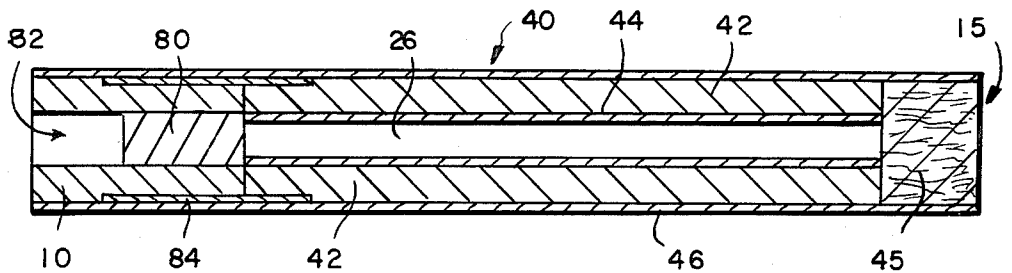


FIG. 7

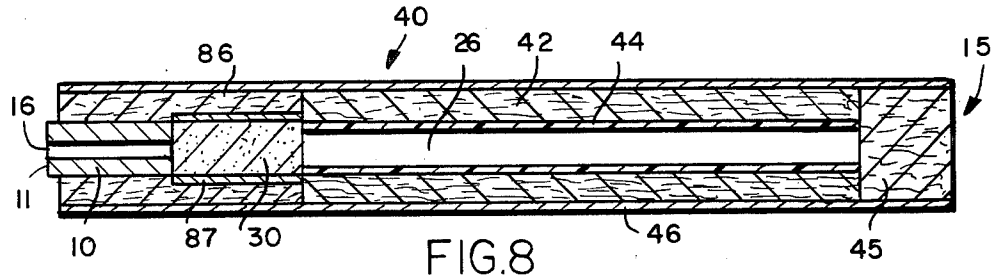


FIG. 8

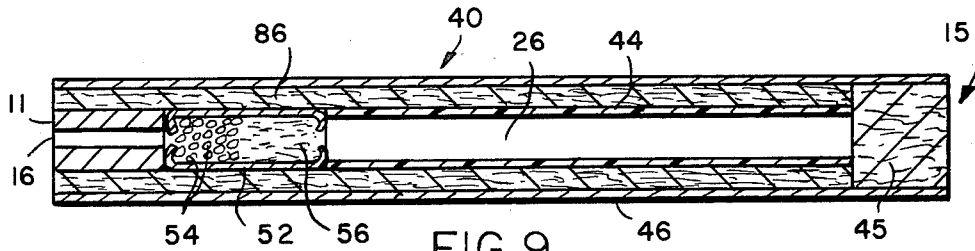


FIG. 9

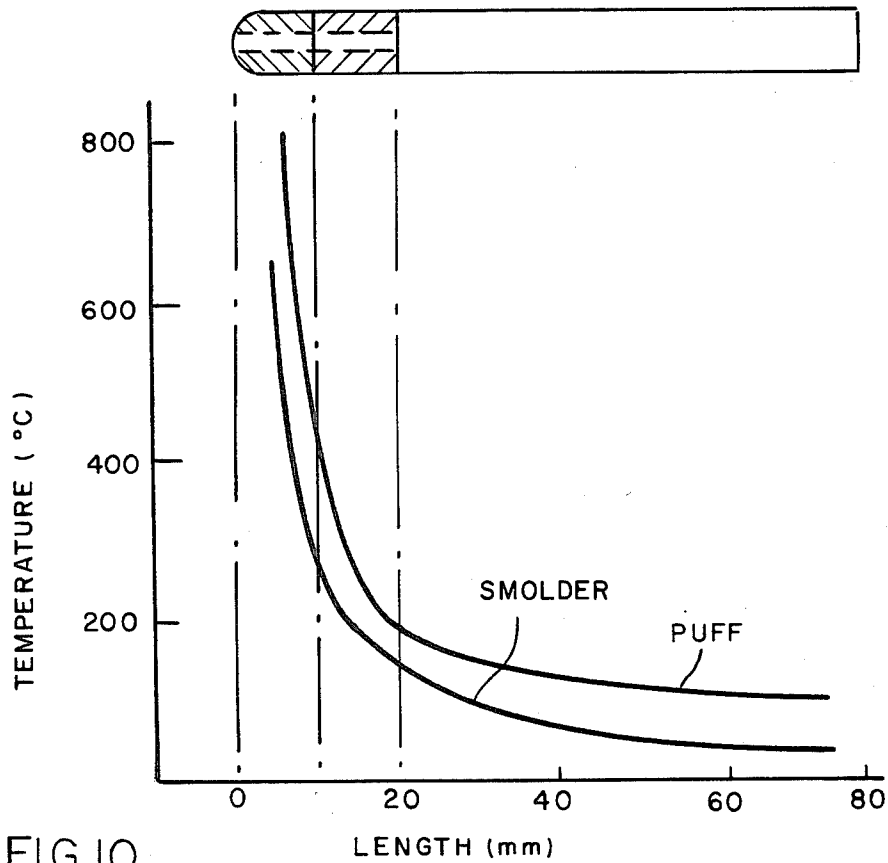


FIG. 10

SMOKING ARTICLE

BACKGROUND OF THE INVENTION

The present invention relates to a smoking article which produces an aerosol that resembles tobacco smoke which contains no more than a minimal amount of incomplete combustion or pyrolysis products.

Many smoking articles have been proposed through the years, especially over the last 20 to 30 years. But none of these products has ever realized any commercial success.

Tobacco substitutes have been made from a wide variety of treated and untreated plant material, such as cornstalks, eucalyptus leaves, lettuce leaves, corn leaves, cornsilk, alfalfa, and the like. Numerous patents teach proposed tobacco substitutes made by modifying cellulosic materials, such as by oxidation, by heat treatment, or by the addition of materials to modify the properties of cellulose. One of the most complete lists of these substitutes is found in U.S. Pat. No. 4,079,742 to Rainer et al. Despite these extensive efforts, it is believed that none of these products has been found to be completely satisfactory as a tobacco substitute.

Many proposed smoking articles have been based on the generation of an aerosol or a vapor. Some of these products produce an aerosol or a vapor without heat. See, e.g., U.S. Pat. No. 4,284,089 to Ray. However, the aerosols or vapors from these articles fail to adequately simulate tobacco smoke.

Some proposed aerosol generating smoking articles have used a heat or fuel source in order to produce an aerosol. However, none of these articles has ever achieved any commercial success, and it is believed that none has ever been widely marketed. The absence of such smoking articles from the marketplace is believed to be due to a variety of reasons, including insufficient aerosol generation, both initially and over the life of the product, poor taste, off-taste due to the thermal degradation of the smoke former and/or flavor agents, the presence of substantial pyrolysis products and sidestream smoke, and unsightly appearance.

One of the earliest of these proposed articles was described by Siegel in U.S. Pat. No. 2,907,686. Siegel proposed a cigarette substitute which included an absorbent carbon fuel, preferably a 2½ inch stick of charcoal, which was burnable to produce hot gases, and a flavoring agent carried by the fuel, which was adapted to be distilled off incident to the production of the hot gases. Siegel also proposed that a separate carrier could be used for the flavoring agent, such as a clay, and that a smoke-forming agent, such as glycerol, could be admixed with the flavoring agent. Siegel's proposed cigarette substitute would be coated with a concentrated sugar solution to provide an impervious coat and to force the hot gases and flavoring agents to flow toward the mouth of the user. It is believed that the presence of the flavoring and/or smoke-forming agents in the fuel of Siegel's article would cause substantial thermal degradation of those agents and an attendant off-taste. Moreover, it is believed that the article would end to produce substantial sidestream smoke containing the aforementioned unpleasant thermal degradation products.

Another such article was described by Ellis et al. in U.S. Pat. No. 3,258,015. Ellis et al. proposed a smoking article which has an outer cylinder of fuel having good smoldering characteristics, preferably fine cut tobacco

or reconstituted tobacco, surrounding a metal tube containing tobacco, reconstituted tobacco, or other source of nicotine and water vapor. On smoking, the burning fuel heated the nicotine source material to cause the release of nicotine vapor and potentially aerosol generating material, including water vapor. This was mixed with heated air which entered the open end of the tube. A substantial disadvantage of this article was the ultimate protrusion of the metal tube as the tobacco fuel was consumed. Other apparent disadvantages of this proposed smoking article include the presence of substantial tobacco pyrolysis products, the substantial tobacco sidestream smoke and ash, and the possible pyrolysis of the nicotine source material in the metal tube.

In U.S. Pat. No. 3,356,094, Ellis et al. modified their original design to eliminate the protruding metal tube. This new design employed a tube made out of a material, such as certain inorganic salts or an epoxy bonded ceramic, which became frangible upon heating. This frangible tube was then removed when the smoker eliminated ash from the end of the article. Even though the appearance of the article was very similar to a conventional cigarette, apparently no commercial product was ever marketed.

In U.S. Pat. No. 3,738,374, Bennett proposed the use of carbon or graphite fibers, mat, or cloth associated with an oxidizing agent as a substitute cigarette filler. Flavor was provided by the incorporation of a flavor or fragrance into the mouthend of an optional filter tip.

U.S. Pat. Nos. 3,943,941 and 4,044,777 to Boyd et al. and British Patent No. 1,431,045 proposed the use of a fibrous carbon fuel which was mixed or impregnated with volatile solids or liquids which were capable of distilling or subliming into the smoke stream to provide "smoke" to be inhaled upon burning of the fuel. Among the enumerated smoke producing agents were polyhydric alcohols, such as propylene glycol, glycerol, and 1,3 butylene glycol, and glyceryl esters, such as triacetin. Despite Boyd et al.'s desire that the volatile materials distill without chemical change, it is believed that the mixture of these materials with the fuel would lead to substantial thermal decomposition of the volatile materials and to bitter offtastes. Similar products were proposed in U.S. Pat. No. 4,286,604 to Ehretsmann et al. and in U.S. Pat. No. 4,326,544 to Hardwick et al.

Bolt et al., in U.S. Pat. No. 4,340,072 proposed a smoking article having a fuel rod with a central air passageway and a mouthend chamber containing an aerosol forming agent. The fuel rod preferably was a molding or extrusion of reconstituted tobacco and/or tobacco substitute, although the patent also proposed the use of tobacco, a mixture of tobacco substitute material and carbon, or a sodium carboxymethylcellulose (SCMC) and carbon mixture. The aerosol forming agent was proposed to be a nicotine source material, or granules or microcapsules of a flavorant in triacetin or benzyl benzoate. Upon burning, air entered the air passage where it was mixed with combustion gases from the burning rod. The flow of these hot gases reportedly ruptured the granules or microcapsules to release the volatile material. This material reportedly formed an aerosol and/or was transferred into the mainstream aerosol. It is believed that the articles of Bolt et al., due in part to the long fuel rod, would produce insufficient aerosol from the aerosol former to be acceptable, especially in the early puffs. The use of microcapsules or granules would further impair aerosol delivery because

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