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POLYETHYLENE TEREPHTHALATE TOBACCO SMOKE FILTER

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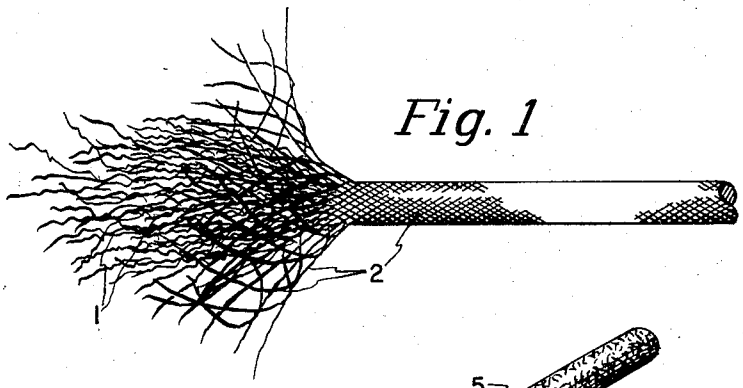


Fig. 1

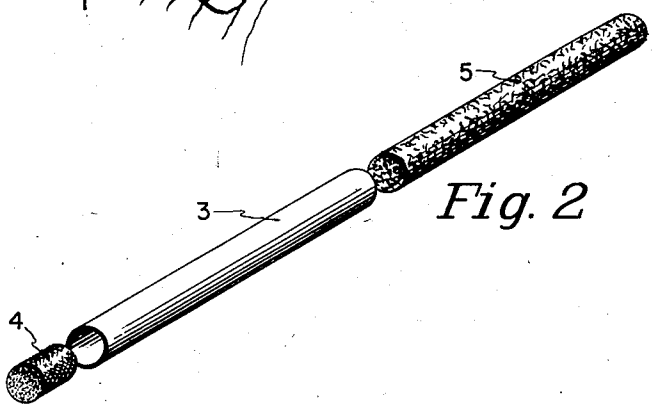


Fig. 2

Fig. 3

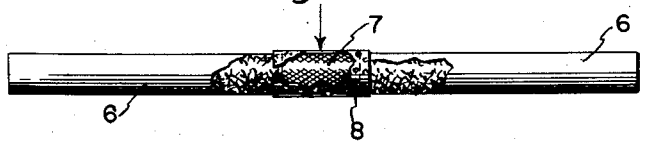
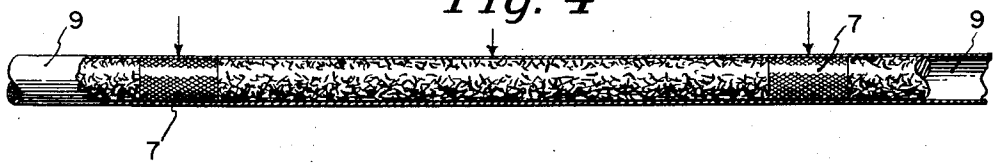


Fig. 4



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POLYETHYLENE TEREPHTHALATE TOBACCO SMOKE FILTER

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3 Claims. (Cl. 131—10)

This invention relates to a novel filter for tobacco smoke. More particularly it is concerned with an improved filter tip cigarette.

It is an object of the present invention to provide a novel process for the filtering of tobacco smoke.

Another object is to provide an improved filtering medium for the removal of suspended material in tobacco smoke.

Another object is to provide a novel process for the manufacture of a filter tip cigarette.

A further object is to provide a novel filter tip cigarette.

These and other objects will become apparent in the course of the following specification and claims.

The requirements of a material to render it satisfactory for use as a tobacco smoke filter and particularly for use in a filter tip for cigarettes, are many. The material must be sanitary, i. e., it should be capable of being sterilized, and be pure in the sense of being substantially free of foreign material having unknown or deleterious effects upon oral consumption by humans. It must be appealing to sight, taste and touch and create no harmful or uncomfortable effects upon the oral mucosae. The filtering material itself must be essentially non-harmful and non-toxic if accidentally consumed or aspirated in small quantities by humans. The tip which is formed must be of sturdy construction. It must not bend out of shape or collapse under the normal pressure of the lips during smoking. It must not crumble either in storage or while the cigarette is being smoked. It must not shift due to the vibration to which it is normally exposed in being carried thereby substantially reducing its efficiency because of channelling. The material must be both efficient and selective in its filtering capacity. It must be capable of tar removal in a small compact area and it must be capable of loose enough packing as to avoid undue back pressure, i. e., a relatively high pressure drop across the filter during aspiration. On the other hand, a cool smoke requires that the moisture and humectant of the tobacco reach the mouth.

In accordance with the present invention a filter for tobacco smoke is provided comprising polyethylene terephthalate filament having a denier per filament within a range of from about 0.1 to 10, fitted within a retaining tube. The tube may be, or be contained within, the extension of a cigarette wrapper, thereby forming a composite or filter tip cigarette. Such a cigarette is preferably formed by feeding a braided stub of an essentially parallel polyethylene terephthalate filament to a conventional cigarette-making machine.

The invention will be more readily understood by reference to the drawings.

Figure 1 is an illustration of a polyethylene terephthalate tow of crimped filament, one end of which is sheathed within a braid.

Figure 2 shows in an exploded view the component parts of a filter tip cigarette.

Figure 3 illustrates an assemblage consisting of two normal size cigarettes disposed on opposite sides of and

axially adjacent to a double size filter plug, the parts being united by a tip wrapper.

Figure 4 shows a rod formed of alternate lengths of double length filter plug and double length tobacco rod within a continuous wrapper.

The filter plugs of the present invention are useful in combination with all types of tobacco smoking devices. They may be inserted within cartridges which serve as holders for cigars or cigarettes. They may be formed to fit filter cartridges or pipes or simply to fit the air channel of the pipe stem. Alternately they may be curled or wadded at the bottom of the pipe bowl. They may be attached to a cigarette to form a composite, tipped cigarette. In each of these application it is convenient to facilitate handling of the filament to employ it in the form of a tow which is sheathed within a braid. Figure 1 illustrates such a tow, about one end of which a braid has been formed. While the type of braid is not important, it is convenient to employ a simple lattice as shown in Figure 1. In this figure a tow of crimped polyethylene terephthalate filament 1, is sheathed within a braid 2. The number of strands forming the braid will vary, as will the tightness of the braid, in accordance with the desired use of the plug and the amount of handling to which it is to be subjected. After the tow has been sheathed it may be cut to any convenient length as desired, i. e., to be used per se, to fill filter cartridges or to provide a hopper feed for conventional filter tip cigarette-making machines. The use of the braid eliminates the necessity of further separate wrapping for the plug. It also eliminates the necessity of an adhesive to bind the filter plug material such as is frequently employed in filter plug manufacture. The braiding filament is conveniently a low denier, continuous filament yarn of polyethylene terephthalate having no twist or a low twist.

Filter tip cigarettes manufacture in automatic machinery generally follows one of three conventional procedures. In one procedure the three components of the cigarette, that is, the filter plug, the tobacco rod and the paper tube are individually manufactured and the components are assembled by inserting a tobacco rod into one end of the paper cylinder and the filter plug into the other end. Figure 2 illustrates the components in an exploded view, paper cylinder 3 being between filter plug 4 and tobacco rod 5. Alternately the paper tube is formed around either the filter plug or the tobacco rod and the remaining component is stuffed into the tube's open end. It will be obvious from a consideration of Figure 2 that the filter plug of the present invention is well adapted to such an assembly process. The braided tow cut to proper length is handled by the assembling machine to form a core for the cylindrical paper wrapper or for stuffing into the open end of a wrapped tobacco rod. A second conventional method of cigarette manufacture by automatic machinery aligns a cigarette axially adjacent to a filter plug and joins the parts thereafter with a wrapper which covers the plug and a portion of the cigarette. More commonly, two cigarettes are so axially aligned with a filter plug of twice the desired final length between them. The attaching wrapper joins the three sections together. The resulting structure is shown in Figure 3. A cigarette 6 is disposed on each side of a double length filter plug 7, the attaching wrapper 8 joining the three components. It is bisected as shown by the arrow to form two cigarettes. A third method of filter tip cigarette manufacture is known as the continuous rod method. In this method the tobacco after combing and carding is showered upon a narrow continuous web of paper. The web carrying the tobacco passes through forming mechanisms which firm up the tobacco into a rod. Filter tips may be inserted at desired intervals, either be placing them upon the

webs and thereafter showering the tobacco between them, removing part of the loose tobacco from the web and replacing it with a filter plug or by cutting out a section of the tobacco rod after its formation and inserting a plug in its place. The web is thereafter wrapped around the alternating sections of tobacco rod and filter plugs and emerges from the assembling machinery as a continuous rod. It is common to form the rod with filter plugs and tobacco sections twice their desired final length so that the cutting operation bisects each of these sections to form the final cigarettes. A typical rod with cutting points designated is shown in Figure 4. Continuous web **9** is wrapped and sealed around the alternate double length filter plug **7** and double length tobacco rod.

The following examples are cited to illustrate the invention. They are not intended to limit it in any manner.

Example I

A 100,000 denier tow composed of 6 denier filaments having 10 crimps per inch is passed continuously into the center of a braid composed of 16 ends of O twist 210 denier polyethylene terephthalate on a standard braiding machine. The rate of feed to braid formation is adjusted to provide a circular cross section. The braided structure is cut to a length of 14 millimeters and is attached at one end of a standard size cigarette by means of a sheath of light-weight cork film. The filter tip cigarette so produced draws easily and provides efficient filtering of the cigarette smoke.

Example II

A commercial cigarette filter cartridge measuring 5/16 inch diameter by 1 inch length and packed with approximately 1 gram of granular silica gel is used to successively smoke three regular length cigarettes. The weight pick-up of the filter media over the smoking period is 0.0062 gram.

The cartridge is emptied of its original filter material and packed with 0.0516 gram of 2 denier per filament polyethylene terephthalate. After smoking three cigarettes as described above, the weight pick-up of the polyethylene terephthalate filter media is 0.0308.

Example III

A loose wad of 0.1 denier continuous filament polyethylene terephthalate is stuffed into a conventional cigarette filter holder. The mechanical smoking of a cigarette, using the device so prepared, displays high efficiency in tar removal as compared with commercially available filter materials.

The optimum filament denier may vary somewhat depending upon the type and amount of tobacco smoke to be filtered and the density of the filter media. Deniers per filament as high as 10 and as low as 0.1 are satisfactory. Filamentary structures having a denier per filament within a range of from about 2 to about 7 are preferred. While the use of a tow of filament facilitates handling and density control, similar funicular structures such as floc, staple, yarn and the like may also be employed. The desirability of high filter efficiency and low back pressure prescribe the use of filter media with high surface area in a low density pack.

Due to the fact that polyethylene terephthalate is preferentially wetted by organic materials, tobacco moisture and hydrophilic humectants are not retained by the filter but pass to the mouth of the smoker permitting a cool smoke. On the other hand, this same property affords a selective pickup of tars and other organic products of combustion which are known irritants to mouth and throat mucosae. It has been found that on a comparative basis the polyethylene terephthalate filter of the present invention is about four times as effective in tar removal from cigarette smoke as is a cellulose acetate filament filter and better than about five times an equivalent length of a tobacco particle filter.

While the filaments of the filter are preferably crimped (from 5 to 40 crimps per inch) to render the path of the smoke more tortuous, uncrimped filaments give efficacious service. The filaments may be in the relaxed (i. e. shrunken) or unrelaxed state. One method of obtaining a highly coherent plug is to shrink a tow (preferably of crimped filaments with or without a braided sheathing) before cutting and wrapping. This may be accomplished by heat, treatment with liquids or other known methods. Coherency can be increased by needle punching the tow before shrinking following the process described in U. S. application No. 312,067 filed September 29, 1952 to H. G. Lauterbach. A simple rope twist upon the tow is also useful in obtaining plug coherence.

The material of construction of the tube with which filter plugs are wrapped to attach them to smoking devices is not critical. Suitable materials include tobacco leaf, paper, cork, wood, metal or the like.

By this invention cigarettes are produced with means for obtaining high efficiency filtration of tars and nicotine. Furthermore, the filter plug cut from braided tow facilitates manufacture of filter tip cigarettes on standard cigarette-making machinery.

While the invention has been described with particularity relative to a filter tip for a cigarette, it is obvious that it is applicable as well to other tobacco smoke filters for pipe, cigars, cigarette holders, cigar helders and the like.

Many equivalent modifications will be apparent to those skilled in the art without a departure from the inventive concept due to a reading of the above description.

What is claimed is:

1. A filter for tobacco smoke comprising polyethylene terephthalate filaments having a denier per filament within a range of from about 0.1 to about 10, and a retaining tube having said filament disposed therein.

2. A cigarette comprising a paper wrapping, a rod of tobacco, a filter plug comprising polyethylene terephthalate filaments having a denier per filament within a range of from about 0.1 to 10 and disposed in one end of said wrapping, and a braid adapted to sheath said filter plug.

3. A cigarette comprising a rod of tobacco, a filter plug disposed immediately adjacent said rod, and a tubular wrapping enclosing said rod and said plug whereby said rod and said plug are maintained in rigid relationship, said filter plug comprising polyethylene terephthalate filaments having a denier per filament within the range of from about 0.1 to 10.

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