Jan. 21, 1958 P. A. MÜLLER 2,820,461

TOBACCO FILTER, PARTICULARLY FOR CIGARETTES

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Fig. 1

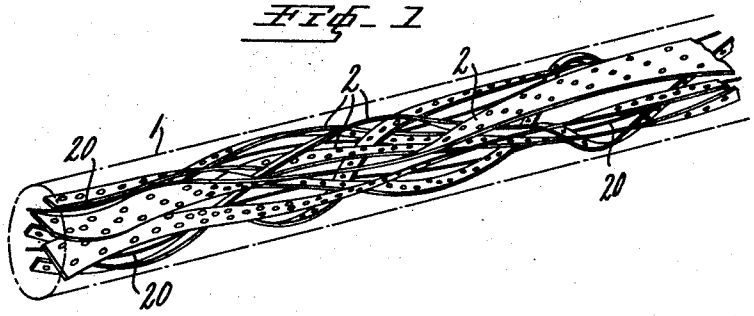


Fig. 2

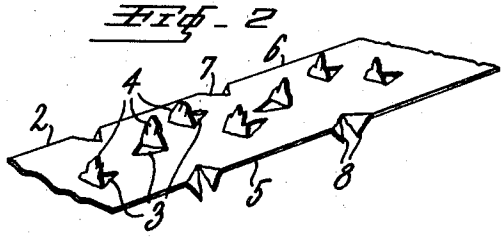


Fig. 3

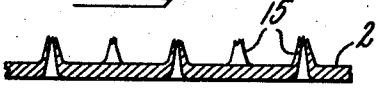
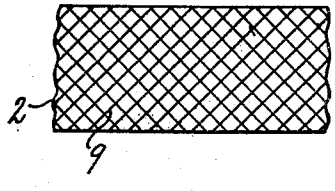


Fig. 4



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Fig. 5



Fig. 6

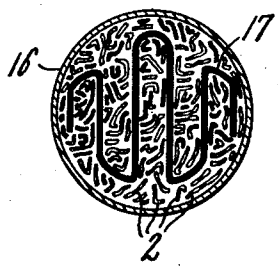


Fig. 7

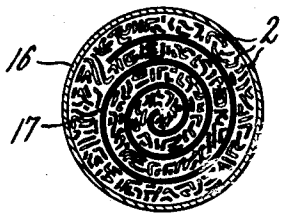
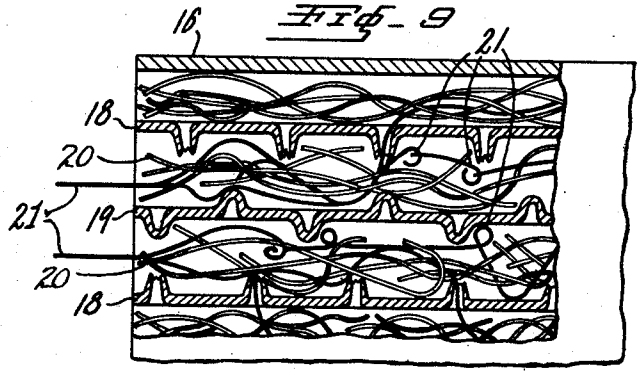


Fig. 8



Fig. 9



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TOBACCO FILTER, PARTICULARLY FOR CIGARETTES

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4 Claims. (Cl. 131—10)

The present invention relates to the continuous production of a tobacco filter, particularly for cigarettes.

The properties which are normally required for a smoke filter, are primarily high absorption so as substantially to diminish the harmful substances in the tobacco smoke without markedly or considerably reducing the porosity of the filter.

By way of example the filters used at present for cigarettes consist of a multi-layer crimped paper web (e. g. multi-layer crimped tissue paper, crimped cellulose wadding) rolled together in longitudinal direction of the filter, with or without intermediate layers of adsorptive materials (e. g. thin strips of wadding inserted between the separate layers of paper). The disadvantage of such filters is that they have pronounced longitudinal ducts through which the smoke can pass unhindered, i. e. unfiltered. To eliminate this disadvantage the suggestion has already been made to arrange a ball of wadding in front of such a filter at the tobacco side, which ball has the task of absorbing the mentioned harmful substances so that the actual filter which follows has only a subordinate importance. However, even such a combined filter is no solution for the problem, apart from the fact that its production is complicated and therefore expensive.

Other cigarette filter inserts made of sponge, wool, wood fibre, fibres twisted together to form a cord, knitted fabrics, flat metal wires and textile fibres, strands of wadding running in the longitudinal axis of the tobacco, a compound of filter paper, etc., have not been generally accepted because either their filtering effect was not technically satisfactory or they were too expensive or were difficult to attach to the cigarettes.

Even the addition of adsorption substances, such as activated carbon, yields no satisfactory improvement because these adsorption substances become partly loose during smoking and are inhaled together with said harmful substances.

Attempts to achieve a greater filtering effect with the aid of chemical agents have not led to a satisfactory result either because in tobacco the nicotine is not in its basic form, i. e. cannot be bound with acid, but is distilled off in the form of colloid salt with the aqueous vapour produced by the moist tobacco. Such colloid salts can only be bound by physical adsorption, for which silicagel and activated carbon are suggested. Silicagel, however, is out of the question because it effects, in essence, only a binding of the water, whereby the smoke is, to be sure, dried, but not purified of its harmful substances. True, activated carbon does not have this drawback, but it fails in practice because it is not possible to mix the material with the cigarette tobacco or, for instance, the wadding, or to press the material together with wadding to form a filter, as no method of binding it to a carrier so that it will resist rubbing has yet been found.

The filtering action, i. e. the separation of nicotine, tar products and other harmful constituents of the smoke,

depends mainly on the surfaces brushed or contacted by the smoke during its passage through the filter.

Furthermore it has already been attempted to produce filters from fibre strands made, by way of example, from acetate silk or cotton wadding. Filters made of pure fibrous material webs, e. g. of acetate or wadding strands, cannot, however, be processed without additional stiffening agents as they have inadequate crushing and compression strength. If, however, a cylindrical smoke filter is so tightly packed with fibres that the fibres' own elasticity gives sufficient strength to the filter, then the latter's porosity is too low, i. e. its tensile resistance is too high. It has already been attempted to eliminate this defect by spraying the fibre strands, before moulding them to form a filter, with chemical agents so as to produce a fibrous framework which is less dense but is stiffened by a plurality of points of mutual adhesion and which has the desired strength. It has, however, been shown that all the known, suitable binding agents, which have an adequate adhesive effect but do not reduce porosity by an inadmissible amount, contain more or less harmful constituents and are not completely odourless.

Finally, an attempt has already been made to produce suitable filters from strips of paper which have dimensions similar to those of tobacco fibres and should be capable of being processed, if normal cigarette machines are used. Here, too, however, it has been shown that a filter of the desired strength, capable of being processed and offering adequate resistance to the pressure of the lips during smoking, has an inadmissibly high tensile resistance.

The present invention aims at producing smoke filtering members whose effective total surface is greater than that of all paper and fibre strand filters known hitherto, without, however, the tensile resistance, with filters made of paper, being inadmissibly high, while with filters made from fibre strands the tensile resistance can be reduced without the necessity of strengthening the fibrous framework by the addition of binding agents.

The present invention contemplate a tobacco filter particularly suitable for cigarettes, and provides means contributing to a filtering member which contains at least a few elongated vortical and condensation strips which are made of a flexible flat material and in which at least one side or elongated surface is provided with irregularities so as to enlarge the surface area.

It is another object of the invention to provide means affording improved filter properties for cigarettes and like tobacco products without substantially increasing the production cost thereof.

These and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawing showing preferred embodiments of the invention.

Various typical embodiments of the invention will now be described in detail in conjunction with the attached drawing in which:

Fig. 1 shows the principle of the invention according to which filter strips are arranged and illustrated more diagrammatically (the materials located between the strips being omitted);

Fig. 2 is a diagrammatic illustration seen in perspective of a strip made in accordance with the invention and provided with perforations and flaps;

Fig. 3 shows a cross-section of a strip in modified form and on an enlarged scale;

Fig. 4 is a top plan view of a modified strip provided with intersecting corrugations;

Fig. 5 is a cross-section through a filter consisting only of compressed strips surrounded by an outer paper sheath;

Fig. 6 is a cross-section through a filter similar to that

of Fig. 5 with an inserted carrier web shaped in meander form;

Fig. 7 is a cross-section through a filter similar to that of Fig. 5 with a carrier web wound to form a spiral;

Fig. 8 is a fragmentary cross-section through a filter consisting of compressed strips and longitudinal fibers surrounded by an outer paper sheath;

Fig. 9 is a longitudinal section through a filter constructed according to Fig. 8, shown diagrammatically and on an enlarged scale.

The results of research show that the absorption of nicotine and tar products from the tobacco smoke can be substantially increased if said smoke passes along elongated narrow strips of flat material which is perforated, stamped or similarly provided with an irregular surface. In a filter consisting of such strips of flat material the surface contacted by the smoke as it flows through the smoking article must necessarily be larger than in the case of a vortical filter which consists of strips of a material which are similar but not provided with surface irregularities. These irregularities, in particular, if they have a sharp-edged or frayed structure, provide, moreover, a plurality of obstacles in the flow path of the smoke, which obstacles result in labyrinthine paths of flow and produce a plurality of randomly distributed vortex centres in the flow of the smoke. In this way the separation of solid and liquid particles from the tobacco smoke is substantially increased.

Furthermore, it has been shown that a condensation effect can be achieved with such vortical strips, particularly when the latter consist of metallized paper or metal foils. The vortical strips always have a lower temperature than the smoke brushing past them so that the vaporous constituents of the smoke are to a large extent condensed and deposited on the surfaces of the strips. As a result of the not inconsiderable thermal capacity of these vortical and condensation strips, they are only slightly heated by the smoke at normal smoking speed. If a filter is constructed from a combination of such vortical and condensation strips together with absorbent fibrous materials such as cotton or cellulose wadding, an optimum filtering effect can be achieved by means of the simultaneous absorption and adsorption which occur.

In a filter constructed of fibrous materials together with vortical and condensation strips the latter, however, particularly if they consist of relatively strong material such as blotting paper or metal foils, also contribute substantially to the strengthening of the filter. Thus the suitable fibrous materials can then be chosen without regard to their strength and only with regard to the best filtering effect—which has not previously been possible—and the requisite strength of the filter can be ensured by means of a suitable frame work of vortical and condensation strips.

The rigid framework made of such vortical and condensation strips which contribute quite substantially towards a good filtering effect also enables, however, fibrous materials to be replaced or supplemented by other absorbent materials such as plastic foam flakes, sponge flakes, viscose foam, etc., the use of which has hitherto led to difficulties owing to their strength being as a rule inadequate.

In tests on filters of the present design, with vortical and condensation strips, it has been discovered that the separation effect in respect of the harmful constituents of the tobacco smoke is only about 50 percent better than with filters made of the same material but without the strips provided with enlarged surface areas. The tensile resistance, however, is substantially less and the strength of the filter enables it to be mechanicaly processed without difficulty.

The basic arrangement of the vortical or twisted strips inside a filter is shown diagrammatically in Fig. 1. In the outer sheath 1, which consists, for instance, of tissue paper (shown in dot and dash lines), there is disposed a plurality of vortical and condensation strips 2, the filter preferably forming an endless elongated rod formation from which the individual filter plugs are cut off to the desired length. Accordingly, the strips 2 may form endless webs which extend along the filter sheath 1 and are combined to form an elongated bundle of strips which are in a randomly chosen position in relation to each other.

Fig. 2 illustrates a typical enlarged embodiment of a section of an endless vortical and condensation strip 2 of this type which is provided with triangular perforations 3. The flaps or protuberances 4, dislodged from the surface of material during perforation, are integral with or attached by one edge to the wall defining each of said perforations or holes 3 and stand out from the web of material. Perforation is preferably effected in such a way that the irregularly shaped edges defining the holes 3 and flaps 4 are frayed and torn. The sides or end faces 5 and 6 of the strip 2 are provided with indentations 7, by way of example, of triangular configuration, the dislodged pieces of material protruding from the level surface of the strip in the form of flaps 8. By means of such perforations and lateral indentations—their number per unit of length and their size can of course be chosen to suit the material and the width of the strip—the surface area of the strip 2 is thus substantially enlarged and a plurality of obstacles to the path of flow of the smoke passing over the surface of the respective strip are created, which obstacles favour the formation of vortex centres.

Instead of triangular-shaped holes 3 and indentations 7 indicated in Fig. 2, other forms of perforations—with or without the flaps of dislodged material being left hanging on the strip—can also be provided.

According to Fig. 3, tubular projections 15 penetrate the flat material 2, pass through it, and form frayed projecting edges, as shown which are hollow or open at their bases and are particularly advantageous for the filtering action.

Another type of vortical and condensation strip wherein the flat material is corrugated or crimped and has double, obliquely intersecting grooves is indicated in Fig. 4.

A combination of perforated and flat strip material is, of course, also possible for use, having; for instance, obliquely corrugated grooves 9 as shown in Fig. 4.

Finally, it should also be pointed out that it is possible to enlarge the surface area of some flat strip materials by roughening same.

It is suitable to use for the vortical and condensation strips a flat material consisting of fibrous substances, for instance absorbent paper or stiffened fleece made from natural or synthetic fibres. Also usable are strips of woven fabric, as well as those made of foil-like, heat-resistant, tasteless and odourless plastics. Compressed plastic foam, with and without surface coating, can be used provided it meets the hygienic requirements. If particular importance is attached to a good condensation effect, it is advisable to use a flat material which has on at least one side a metallic surface which may be compact or disconnected. By way of example, paper metallized on one or both sides can be used for this purpose, as can thin metal foil made of aluminium and other suitable metals.

Filters according to the present invention may, for instance, contain exclusively vortical and condensation strips of the type described. A cross-section through such a filter is illustrated diagrammatically in Fig. 5 in which 16 indicates the outer sheath and 2 the vortical and condensation strips which extend and are grouped as in Fig. 1 and are compressed into a bundle. Strips of varying width, with surfaces of different configuration and made from different materials can, of course, also be combined with each other. By way of example, grooved strips of fibrous material can be combined with

perforated metal strips to form bundles and deformed to produce a filter having high degree of efficiency.

It may be desirable to provide such filters with a carrier web **17** which, as shown in Figs. 6 and 7 respectively, is arranged to form a meander or spiral form and is surrounded on all sides by vortical and condensation strips **2**. These carrier webs **17** may have the same surface structure as that described above in conjunction with Fig. 2 or 4 for the vortical and condensation strips **2**. Also, the material of the carrier webs **17** can be chosen in accordance with the strips **2**.

As already mentioned, the combination of vortical and condensation strips with fibrous materials is particularly advantageous. Such a filter is illustrated diagrammatically in cross and longitudinal section, respectively, in Figs. 8 and 9, a bundle or rod composed of compressed perforated strips **18**, stamped strips **19** and fibrous strands **20** being provided in an outer sheath **16**. In such a filter a plurality of vortex centres form in the path of the smoke, as indicated by the flow lines **21**, which favorably influences the filtering action. The fibrous strands **20** run in the same direction as the vortical and condensation strips **18**, **19**, i. e. in the longitudinal direction of the filter.

The fibrous material **20** which is hydrophilic may be of natural origin, such as cellulose fibres, cotton wadding, etc., or of synthetic origin, such as rayon, acetate viscose fibres.

The multi-layer strip formation may be covered with fibres and perforated, to result in filters which have a larger content of strips and a smaller content of fibrous material (see Fig. 1) than the filter illustrated in Figs. 8 and 9. It is, however, important here that the multilayer, endless strip formation be arranged inside the filter as shown in Fig. 1.

In place of the fibrous materials, or in combination with them, randomly distributed flakes of sponge or foam-like material can also be provided in the filter inside the vortical and condensation strips. Suitable for this purpose is plastic foam having hollow spaces which intercommunicate at least in part and are made, for instance, of carbamide resin. Foam or sponge-like compounds made from viscose lamellae, latex foam, neoprene foam, etc. are also suitable.

The fibre-containing and flake-containing filters can, of course, also be provided with a carrier web according to Figs. 6 and 7 and the combination of vortical and condensation strips with fibrous materials and foam flakes, as well as with a carrier web, is likewise possible.

It can thus be seen, that there has beeen provided according to the invention a filter for a tobacco smoking article which consists of a rod-shaped filter element provided with a plurality of strips, each strip being substantially coextensive in length with that of said rod-shaped filter element and being slightly twisted about its axis and about adjacent strips, said strips being haphazardly arranged in elongated bundle formation and consisting at least partly of flexible absorbent material, which possesses at least one substantially flattened surface and an opposite surface provided with irregularly shaped integral projections terminating in substantially frayed edges, said projections being struck out from said strips to provide perforations through said strip material at the respective bases of said projections, to thereby enlarge the filtering surface area, and hydrophilic cellulose fibers of relatively small dimensions interspersed between said strips in a random fashion to thereby provide a tortuous path for the smoke to follow when travelling through said filter element, said filter element having a sheath surrounding and maintaining said filter element in its rod-shaped form.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A filter for a tobacco smoking article, in particular for a cigarette; comprising a rod-shaped filter element provided with a plurality of strips, each strip being substantially coextensive in length with that of said rod-shaped filter element and being slightly twisted about its axis and about adjacent strips, said strips being haphazardly arranged in elongated bundle formation and consisting at least partly of flexible absorbent material, each of which possesses at least one substantially flattened surface and an opposite surface provided with irregularly shaped integral projections terminating in substantially frayed edges, said projections being struck out from said strips to provide perforations through said strip material at the respective bases of said projections, to thereby enlarge the filtering surface area, and hydrophilic cellulose fibers of relatively small dimensions interspersed between said strips in a random fashion to thereby provide a tortuous path for the smoke to follow when travelling through said filter element, said filter element having a sheath surrounding and maintaining said filter element in its rod-shaped form.

2. A filter according to claim 1, said projections being substantially flap-shaped.

3. A filter acccording to claim 1, said projections being tubular-shaped and open at their frayed edges.

4. A filter for a tobacco smoking article, in particular for a cigarette; comprising a rod-shaped filter element provided with a plurality of strips, each strip being substantially coextensive in length with that of said rod-shaped filter element and being slightly twisted about its axis and about adjacent strips, said strips being haphazardly arranged in elongated bundle formation and consisting at least partly of flexible absorbent material, each of which possesses at least one substantially flattened surface and an opposite surface provided with irregularly shaped integral projections terminating in substantially frayed edges, said projections being struck out from said strips to provide perforations through said strip material at the respective bases of said projections, to thereby enlarge the filtering surface area, and hydrophilic cellulose fibers interspersed between said strips, the contents of the strips of the filter element being larger than the contents of said fibers, whereby a tortuous path for the smoke to follow is provided when said smoke travels through said filter element, said filter element having a sheath surrounding and maintaining said strips and said fibers in assembled form.

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