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**93734**  
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 [45] Patented **Aug. 3, 1971**

[56] **References Cited**  
**UNITED STATES PATENTS**  
 2,808,057 10/1957 Jaksch..... 131/10.1  
 3,122,145 2/1964 St. Louis..... 131/10.1 X  
 3,251,365 5/1966 Keith et al. .... 131/10.7  
 3,297,038 1/1967 Homburger ..... 131/10.1 X  
 3,390,686 7/1968 Irby et al..... 131/266

**FOREIGN PATENTS**  
 1,889,769 3/1964 Germany..... 131/10.1

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[54] **TOBACCO SMOKE FILTER**  
**7 Claims, 5 Drawing Figs.**

[52] U.S. Cl..... 131/266,  
 131/10.1, 131/10.7, 131/267  
 [51] Int. Cl..... A24d 1/04,  
 A24f 7/04  
 [50] Field of Search..... 131/10.1,  
 10.5, 261 B, 10 R

**ABSTRACT:** A frangible tobacco smoke filter composed of a resilient tubular casing and a unit consisting of interconnected, opposed seals. When the smoker applies pressure to the casing, the unit is broken thereby allowing for passage of the tobacco smoke through a smoke-treating medium contained within the casing.

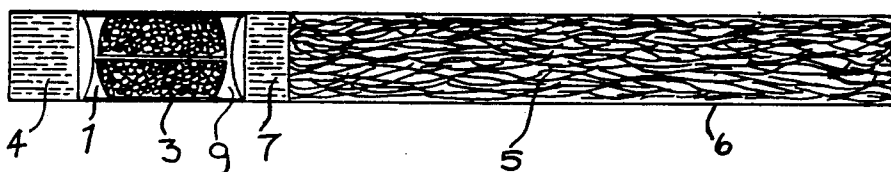


Fig.1

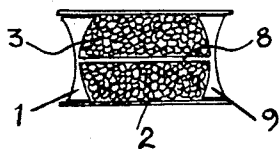


Fig.2

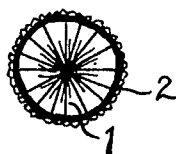


Fig.3

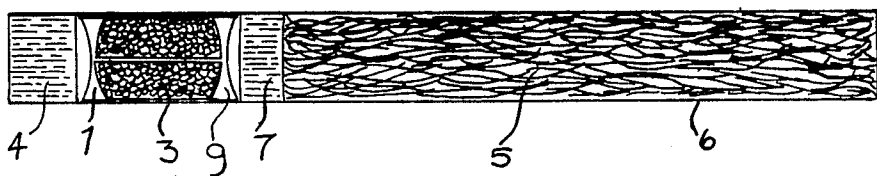


Fig.4

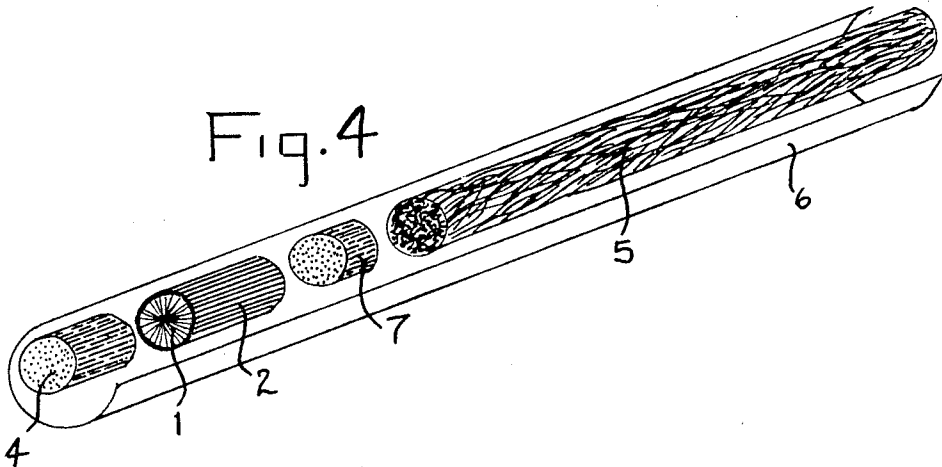
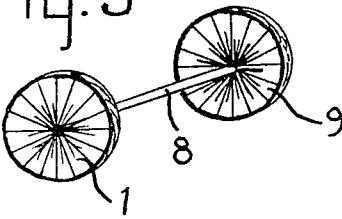


Fig.5



## TOBACCO SMOKE FILTER

This invention relates to the construction of a novel frangible filter element designed for containing smoke-treating media for removing deleterious materials from tobacco smoke. The filter element is primarily intended for use attached to cigarettes and cigars but may be constructed as a separate cartridge for cigarette or cigar holders and pipes.

The filter consists of one or more frangible containers located within the cigarette, cigar or pipe. The filter element is designed to collapse or fracture under intentionally applied pressure by the smoker. Upon fracture or collapse of the container, a smoke-treating medium is thus exposed to the tobacco smoke stream. The tobacco smoke stream is drawn through the filter element and is filtered or reacted upon by the smoke-treating media contained therein which may be sorbents, catalysts or any substance specifically designed to remove deleterious substances from the tobacco smoke stream prior to same being inhaled by the smoker. The frangible filter invention is claimed as new because it provides novel economical means for conserving activated smoke-treating media for maximum efficiency until use. The conservation effect in this case refers to the sealing effect of the filter element which guards the smoke-treating medium from saturation or loss of reacting efficiency stemming from prolonged exposure to the atmosphere or agents contained within the tobacco mixture itself. Likewise, the present filter invention will protect the smoke-treating media against exposure to agents contacted during the filter incorporation process. The invention thus will enable and improve the utilization of smoke-treating media which are otherwise anhydrous, evaporative or deliquescent in nature such as bentonite, moisturized charcoal particles, silica gels or liquid-entraining fibrous material.

It is an object of the invention to construct a frangible filter element that is economical through usage of simple parts and which lends itself to automated production to the greatest extent.

Tobacco smoke in general consists of a gaseous phase in which liquid, semiliquid and solid particles are suspended. The principle of cigarette filters is to remove part or all of certain designated health-affecting substances produced by the incomplete combustion of the tobacco mixture. In general, these substances are lumped together under the description as tar and nicotine; but gaseous substances such as hydrogen sulfide, carbon monoxide, ketones and other complex, toxic gases of organic origin are also present. The commonly utilized filters of commerce remove from the smoke stream varying portions of these substances. Numerous methods and processes are employed, and the individual chemical as well as physical properties of the filter materials remove more or less efficiently specifically targeted substances. Some of these properties can be defined as active through sorption, anion or cation exchange, diffusion impactive or direct collision of the smoke particles with the filter element constituents.

It is one of the objects of the present invention to augment and to preserve sorbent qualities of sorbent filters. It has been noted that the sorbent functions of filter materials such as silica gel, alumina, clays and charcoal, whether pure or chemically treated, largely account for the targeted elimination of selected substances from the tobacco smoke. Such sorbent filters, whether inherently catalytic in nature or catalyst containing, are, however, only partially effective for several reasons.

One of the more important reasons is that during the filter incorporation and handling the sorbents come in contact with chemicals, vapors and substances which partially or completely block the absorbent surfaces of the smoke-treating media thereby reducing the sorbent capacity. It is an object of the present invention to augment the capacity of sorbent filters by hermetically isolating these until exposed to the tobacco smoke stream when activated by the user.

The addition of various salts, iron oxides or other chemicals of deliquescent nature to silica gel, alumina or charcoal can only be effected at the present within the degree permitted by

the presence of water vapor in the air or various substances, aromatics, flavors or oils contained in the tobacco mixture. It is therefore an object of the invention to permit augmentation or full use of anhydrous, evaporative, or deliquescent agents within the filter element not feasible in presently marketed filters.

Another object of the present invention is to improve the impactive filtering effect of granular filters. This effect is achieved through a separate advantage of the frangible element.

When the seals of the containers fracture, they fragment but do not fully disintegrate. The fracturable portion of the end seals and the size of resultant fragments can be influenced through a variety of structural surface patterns. The result is larger or smaller relatively narrow surface patterns. The result is larger or smaller relatively narrow cracks through which the smoke stream is drawn with a differential in pressure and with resultant concentration and increase in velocity of smoke particles. This increase in velocity aids in furthering the impactive properties of filter materials wherein smoke particles are retained on granular or pulverulent smoke-treating media by surface attraction.

Still another object and advantage of the frangible filter as invented and described herein is that it may be manufactured and incorporated in cigarettes through the use of automated machinery without major modifications. To construct a filter capsule with two frangible seals or areas in the shape of discs, or cups, at opposed ends of the frangible filter, several methods have been contemplated. One consisted of cutting lengths of resilient tubing and filling the resultant cylinders with smoke-treating media and then affixing individual seals singularly in both ends in the form of caps that were subsequently glued or heat sealed. This method in its current state of art proves too slow to be economical.

Another method consisted of encapsulating the smoke-treating media with brittle plastic or glass by machine processes, as are known in pharmaceutical practices and then coating with resilient plastic. The coating was necessary in order to avoid causing injury to the smoker's fingers when using the element as sharp fragments were produced. Another version considered was that of incorporating several small cylinders each containing a smoke-treating medium within one resilient casing. The aforementioned processes did not provide the automated ability incorporated in the present invention and although feasible they did not respond to the requirement for economical manufacture.

The object of the invention then concerns a means for providing a frangible filter element comprising a resilient tube casing with two independent frangible seals and overcoming the difficulty of handling the seals singularly and individually. To achieve the desirable effect of handling the end seals as a unit, the two seals in the form of discs or cups are joined by a connecting bar coaxially situated and placed in such way as to maintain the end seal discs or cups perpendicular to the walls of the resilient casing. The connecting bar between the discs or cups is centrally situated for convenience. The connecting bar can equally be transversely extended from the rim of a seal disc to the rim of the opposite seal disc in order to facilitate the utilization of clayey or spongy filter materials. The proposed difference in connecting the end discs or cups shall not be intended to be a deviation from the intent and principle of this invention. The unitized end discs and connecting bar figuration singularly resembles a spool and shall hereafter be referred to as filter spools. The term filter spool is used because of the visual resemblance; however, utilization as a fixation point for threadlike or fibrous material is envisioned. Hollow spheres, through cutting after manufacture of a rod containing many spools, shall be considered to constitute the intended disc or rather cup seals within the scope of this invention.

The frangible filter as described can be the only filter for use in a cigar, pipe or cigarette holder or it can be added to other filters or with flavor containers so as to become multipurpose.

Objects and advantages, including novelty, will be apparent to those skilled in the art, from reading the specification and claims, in conjunction with the accompanying drawing, in which:

FIG. 1 is a longitudinal cross-sectional view of the frangible tobacco smoke filter element.

FIG. 2 is a cross-sectional view of the filter element at either end.

FIG. 3 is a longitudinal cross-sectional view of the frangible tobacco smoke element installed in a cigarette.

FIG. 4 is an exploded view showing the relative position of the frangible tobacco smoke filter within a cigarette.

FIG. 5 is an elevated enlarged view of the filter spool.

Referring to FIG. 1 the frangible filter element of the invention comprises an outer resilient casing 2 which surrounds a smoke-treating medium which may be granular as shown but which can also be fibrous or pulverulent. A prerequisite for the smoke-treating medium is adequate porosity necessary to permit passage of smoke stream. The seals 1 and 9 at the ends are shown with serrated surfaces; however, any other suitably patterned surface configuration, for example indented squares, may be utilized. The connecting bar feature 8 between the seals is further described herein. Various materials for carrying out the construction of the frangible element are apparent. The filter element casing 2 may be chosen from suitable materials chosen from the groups metal, glass, paper, rubber or plastics. The only prerequisite for the casing is to be resilient, tasteless and odorless. The material for the filter spool unit comprising seals 1, 9 and the bar 8 is to be selected preferably from the group plastics and in particular a type like plexiglas which appears to possess the fragmental, friable qualities that are desired. Micas, for an example, may equally be used but plastics are preferred for reason of moldable quality so that the spool can be molded in one piece. The feature of friability to the point of pulverization is not necessarily desired.

In FIG. 2 an end section of the frangible filter element is shown. The casing 2 is illustrated with an irregular exterior surface rather than plain. A foam-textured exterior surface or a surface with elevated patterns is desired to provide for a cushion effect to intimately accommodate an intermediate filter wrapper or final wrapper such as the cigarette paper involuting the tobacco charge and the filter components.

FIG. 3 depicts a longitudinal view of a cigarette with the frangible element installed. The fibrous plugs 4 and 7 are mainly designed to guard against the smoke-treating medium filter reaching the mouth of the smoker or contacting the tobacco charge. The fibrous plugs 4 and 7 may or may not enter into the filtering process as desired. The conventional mouthpiece wrappers or filter paper wrappers found in cigarettes are not shown in the drawing as they are superfluous to the identification of the invention.

FIG. 4 is an exploded view showing the intended position of the frangible filter element in a smoking article.

FIG. 5 is an elevated view of the filter spool comprising end seal discs 1 and 9 and connecting bar 8. The connecting bar 8 is coaxially centered as illustrated, however, it is the connecting feature that is an object of the invention and any placement could be made. The connecting bar 8 could be placed diagonally between rims of seals 1 and 9 or as many as three bars could be placed at 120° intervals from rim to rim. The form of a spool as shown would enable utilization of fibrous, threadlike materials by winding or wrapping around the connecting bar 8. As an example, such use would include the use of moisturized cotton or a combination of cotton with moist carbon particles. Likewise, it is possible to manufacture the spool with the bar 8 as a spiral, or angularly, should it be desired. The end discs 1 and 9 of the spool in the preferred form are concave-concave in both ends; however, concave-convex and convex-convex are equally acceptable. The purpose of concaving or convexing is to impart some structural strength to the seals to allow for sufficient back pressure against the surrounding casing in order to provide the desired

sealing effect.

To produce the filter element presently a continuous train of linked filter spools is manufactured. Each filter spool as linked together is 6—9 mm. long and the diameter of the end seals is approximately 6 mm. or as determined by the desired diameter of the cigarette. The linked spools are approximately 3 mm. apart. The train of linked filter spools is then fed upon a continuous U-shaped plastic sheet. The spools are spaced 3 mm. apart and when placed in the bottom of the U-shaped sheet they form individual compartments into which the filter mixture is metered. A filling machine, such as a rotary filling apparatus with a metering bar, can fill any number of compartments at one time, the limit being only the length of the metering bar and the desired length of the composite filter rod to be manufactured. The plastic sheet is then folded or roller towards the center and sealed to form a rod constituting multiple filter elements. Preferably the finished rod is heat sealed at the jointure; however, dependent upon the nature of the smoke-treating filler, a satisfactory glue or adhesive may be utilized. Another sealing method would be roll wrapping several times using thin plastic sheet or film. Likewise, pressure problems caused by machine production may be overcome by using foam-textured plastic material as casing or as cover for the casing. The resultant filter rod is then cut into individual lengths representing the frangible filter elements and fed to a filter composite making machine. The sealing effect may be further augmented by thermoelectric wire cutting of the rod next to the end seal or a heat seal may be added to round the edges at the end seal to provide a firm hold. Lacquers, sealants or hardeners may be added to the exterior of the casing where warranted. The entire frangible filter configuration consisting of the two end plugs and the frangible filter element is the wrapped in a filter-wrapping machine and subsequently incorporated into the cigarette.

In another version of manufacture an individual filter spool is added to a chamber created by the opposed ends of two fibrous plugs, a smoke-treating medium is introduced and the components are involuted in plasticized paper or plastic film wrapper which then creates the casing. Such utilization of the filter spool is but an example which is considered to be within the scope of this invention.

Various details of procedure and operation have been set forth above for the purpose of giving a clear understanding of the invention but are not limited to the exact details given as it includes modification and changes coming within the scope of the appended claims.

Having thus described the invention, what I claim as new and desired by Letters Patent is:

1. A tobacco smoke filter element comprising a tubular, resilient casing, said casing sealed at both ends with frangible, plastic, transversely extending seal discs, said seal discs having the peripheral portions in continuous contact with the interior wall of the casing, said seal discs interspaced to provide a chamber within the casing for containing a smoke-treating medium, an axially extending plastic bar through said chamber and integrally molded with said seal discs to form a single one-piece, spoollike unit, said seal discs to be broken by the smoker to provide a passage for the tobacco smoke and expose it to a smoke-treating medium when intentionally applying pressure to the casing.
2. A filter element according to claim 1 wherein the seals are discs, each disc having at least one curved surface.
3. A filter element according to claim 1 and including upstream and downstream of said spool unit.
4. A filter element according to claim 1 wherein the casing is constructed of plastic film.
5. A filter element according to claim 1 wherein the casing is foam-textured material.
6. A filter element according to claim 1 wherein the smoke-treating medium is a sorbent.
7. A filter element according to claim 1 wherein the smoke-treating medium consists of moisturized carbon particles.

**UNITED STATES PATENT OFFICE**  
**CERTIFICATE OF CORRECTION**

Patent No. 3,596,665 Dated August 3, 1971  
Inventor(s) Knud Lindgard

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet [72], "436" should read -- 448 --.  
Column 1, line 68, "absorbent" should read -- adsorbent --.  
Column 2, lines 14 and 15, cancel "The result is larger or smaller relatively narrow surface patterns"; line 19, "inactive" should read -- impactive --; line 28, "filer" should read -- filter --. Column 4, line 14, "roller" should read -- rolled --; line 63, after "including" insert -- fibrous plugs --.

Signed and sealed this 30th day of May 1972.

(SEAL)  
Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

ROBERT GOTTSCHALK  
Commissioner of Patents