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H. A. LEBERT

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FILTER TYPE TOBACCO SMOKING STRUCTURE FOR REMOVAL OF TAR

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Fig. 1

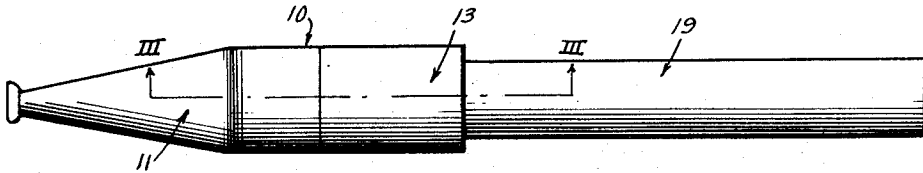


Fig. 2

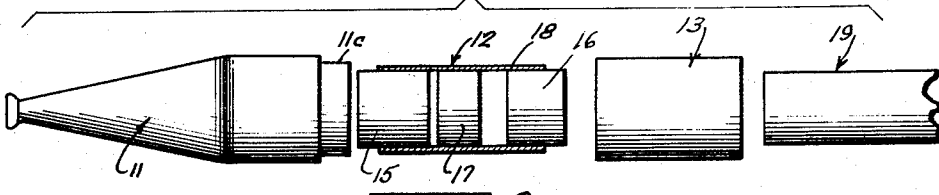


Fig. 3

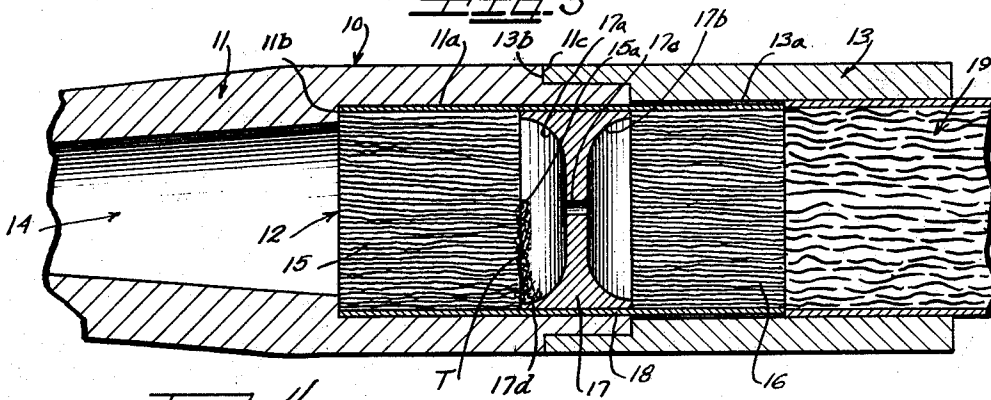


Fig. 4

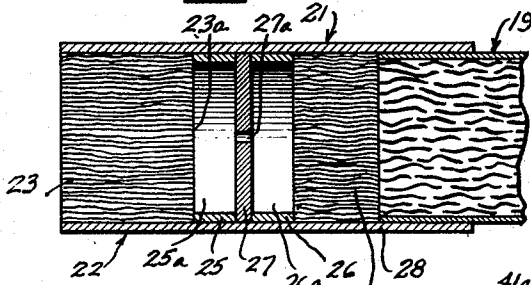


Fig. 5

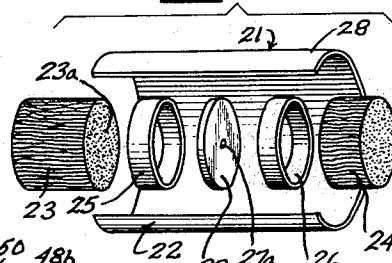
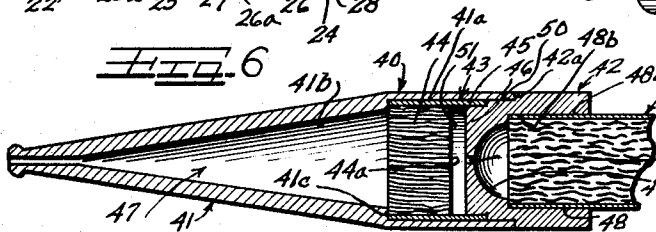


Fig. 6



Inventor
Herbert A. Lebert

By Hill, Sherman, Melvin, Reed & Simpson Attorneys

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FILTER TYPE TOBACCO SMOKING STRUCTURE FOR REMOVAL OF TAR

Herbert A. Lebert, Millbrae, Calif., assignor to MacFarland, Aveyard & Company, Chicago, Ill., a corporation of Delaware

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This invention relates to the removal of tar and other deleterious substances from tobacco smoke and particularly to an orifice and impingement barrier combination for the removal of tars, resins, and other harmful substances in the smoke. In the following description, such harmful substances will be referred to for convenience as "tars."

In the past, many devices have been proposed for the treatment of tobacco smoke and for the elimination of portions or fractions of component parts of the smoke therefrom. The removal of tars has posed a serious problem because of their known harmful effects to health. Screens and orifice-equipped disks have been proposed, the effective opening for the flow of smoke being quite minute, but while some tar is removed in the operation of such devices, a satisfying flow of smoke is not obtained. Furthermore, a sufficient proportion of the tars are not removed.

The present structure or tar filter device fundamentally differs from previous types of tar filter devices by obtaining tar separation by means of providing a structure adapted to cause tar separation by impingement of high velocity tar ladened smoke against an impingement barrier. Certain of the aforementioned patented cooling devices bring about a peripheral cooling of the smoke but allow substantial core portions of the tars to pass on to the smoker. According to certain principles of the present invention, the entire cross-section of the smoke stream is subject to the action of the impingement barrier so that tars and the like are removed by high velocity smoke impingement against the barrier. Tests tend to indicate the present new technique is far more effective than any previously known tar filtering device in effectively removing tars and especially the more dangerous high temperature tars from tobacco smoke while at the same time enabling the smoker to obtain a pleasurable smoke without a hard draw.

The results of research by independent experts in this field tend to indicate that the tars extracted from the lower temperature-burning ranges (560° to 720° C.) produce few or no cancers. The number of cancers increased sharply through the use of tar taken from tobacco burning from the higher temperature ranges (720°-880° C.). Tests have also shown that a cigarette burns between 800° to 880° C. so that the more dangerous high temperature tars are presently being inhaled by the cigarette smokers. (See Time magazine, April 22, 1957, page 50.)

Early experiments indicate that where the velocity expansion cooling principle is used to obtain tar separation, a relatively low percentage of the high temperature tars are separated out of the smoke as opposed to the use of the instant relationship involving high velocity tobacco smoke impingement without expansion wherein a relatively high percentage of high temperature tars are separated.

In the application of this new technique, manufactur-

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ing advantages are present since structures of this type are far more compact than those using the velocity-expansion principle where a relatively large chamber is required for condensing the smoke.

It has been found that there is a practical dimensional range with regard to the size of the orifice and its distance from the barrier. If the orifice is too small the smoker is inconvenienced through his difficulty in drawing the smoke through the device, and if the orifice is too large, the velocity of the smoke passing through the device is reduced in a manner whereby the percentage of tar separation is materially reduced. If the gap between the orifice and the barrier is too great or too small the percentage of tar separation or the rate of tar flow is adversely effected. In this respect, the impingement barrier is almost in contact with the orifice with there being just enough clearance to allow the formed relatively viscous tar to flow out of the path of the tar subsequently formed. There is no expansion space or condensing surface as in the above patents required here for tar separation from the smoke.

According to the present invention, an important object is to form the critical sized smoke passage or venturi in the smoke passage area so that the venturi will operate to speed up the smoke to a terrific velocity exceeding, e.g. 100 ft. per second so that the heavy (high-temperature formed) tar molecules or particles will not be able to meander their way through the smoke passage-way area, but will, instead, impinge against and come to rest on the impingement barrier that confronts or stands in their high-speed, straight line path from the venturi area. The lighter weight aromatic, low-temperature formed smoke particles or fractions which go to make up a safe, enjoyable smoke will be allowed to pass through the impingement barrier area and out through the open end of the tobacco smoking structure into the mouth of the smoker.

In the past, expansion cooling of tobacco smoke has been practiced and structures developed to attain this end have required an elongated expansion chamber for the smoke to expand which structure is conventional in the art. According to the present invention, the manufacturing cost of the tobacco tar removal structure may be kept to a minimum since the expansion chamber is not required. Where the present tobacco tar removal structure is assembled with a cigarette to form a filter tip cigarette, the overall length of the filter tip may be reduced if desired without interference with the tar removal operation of the filter tip.

By using an orifice with a .028" to .030" diameter and a distance between the impingement barrier and the orifice of $\frac{1}{32}$ " to $\frac{1}{16}$ ", the best results are obtainable. In other words, by constructing a device incorporating the above dimensional range, the smoker may have a more pleasurable easy draw smoke with the high percentage removal of the tars including the more dangerous high-temperature tar. Early tests of structure utilizing this principle tend to indicate that at least 40% of the tars may be removed. This 40% represents nearly 100% of the high-temperature tars, the low temperature aromatic fractions or tars are passed on to the smoker.

If the tobacco tar removal structure is manufactured with an orifice or venturi area, for example, equivalent to a .0006-.0008 square inch area, all the tars regarded harmful by modern medical thinking will be deposited that is, impinged on the impingement barrier and thereby removed from the tobacco smoke.

Accordingly, a very important object of the present invention is to provide means for the tar removal from tobacco smoke through the use of an impingement barrier employed at a spaced and effective distance from a venturi orifice or a small orifice which causes the smoke to

flow at a sufficient velocity to cause separation of the tar as the smoke strikes the impingement barrier.

Another object of this invention is to provide a multi-part cigarette structure having novel means for separating tars including a high percentage of high-temperature tars from tobacco smoke while at the same time allowing the smoke to be drawn through the cigarette holder without great difficulty enabling a smoker to obtain a pleasurable smoke without the danger attendant with the drawing of the high-temperature tars into the body and lungs of the smoker.

Another object of this invention is to provide a new and improved tobacco tar removal structure which may be readily assembled with a cigarette holder structure, and which may be inserted internally of a sleeve to provide a filter tip cigarette.

A further object of this invention is to provide a simplified tobacco tar removal structure which may be manufactured and assembled at a relatively low cost as compared to where conventional cellulose type filters are employed.

Yet another object of the present invention is to provide a highly compact tobacco tar removal structure for separating tobacco tars from tobacco smoke.

While the tobacco tar removal structure has been illustrated in conjunction with a cigarette and a cigarette holder it will be appreciated the structure could also be used in other tobacco smoking structures such as a pipe or a holder for cigars and the like.

Other objects and features of the present invention will more fully become apparent from the following detailed description taken in conjunction with the accompanying drawings illustrating therein several embodiments and in which:

Figure 1 is a side elevation of a cigarette holder having a cigarette mounted in assembly therewith with the holder carrying a tobacco tar removal structure according to the features of the present invention;

Figure 2 is an enlarged fragmentary cross-sectional exploded view of the assembly shown in Figure 1;

Figure 3 is an enlarged fragmentary cross-sectional view taken substantially on the line III—III of Figure 1 looking in the direction indicated by the arrows;

Figure 4 is an enlarged fragmentary cross-sectional view of a filter tip cigarette showing a modified application of the tobacco removal structure shown in Figures 1-3;

Figure 5 is an enlarged exploded view of the filter-tip having the tobacco tar removal structure as is shown in Figure 4; and

Figure 6 is a fragmentary cross-sectional view of still another modified form of the present invention showing a cigarette holder and a cigarette in assembly together.

The reference numeral 10 designates generally my multi-part cigarette holder which includes a mouthpiece 11, an insert type tobacco tar removal structure 12, and a tubular sleeve 13. The mouthpiece 11 may be made from any suitable materials and excellent results may be obtained through the manufacture of the mouthpiece from a suitable thermo-plastic material, and the like. The sleeve 13 may be manufactured from any suitable materials such as aluminum and the like. The mouthpiece 11 and the sleeve 13 each possess internal circular surface areas 11a and 13a which together define a longitudinal central smoke passageway 14 to permit free flow of the smoke longitudinally of the cigarette holder 10.

The tobacco tar removal structure 12 includes three circular disc-like elements 15, 16, and 17. The elements 15 and 16 are comprised of a suitable fibrous material such as cellulose and the like and are of a type to allow smoke passage longitudinally therethrough. The circular disc-like member 17 comprises a transverse smoke passageway blocking portion and is dished at 17a and 17b with the dished area 17a defining spacing means for longitudinally spacing a venturi passageway area indicated generally at 17c from an impingement barrier area 15a

provided on the circular member 15. In this respect it should be noted the impingement barrier 15a confronts the downstream end of the venturi area 17c in axial alignment therewith so that smoke flowing through the venturi 17c will strike the impingement barrier 15a.

The dished area 17b comprises a smoke collection area which is centered on the venturi passageway area 17c at the upstream side thereof, enabling smoke to be collected therein prior to its passage through the venturi area 17c.

The circular member 16 is made of the same material as the circular member 15 and functions as means for preventing tobacco shreds or particles from passing through the filter structure 16 to reduce any likelihood of the venturi passageway area 17c being clogged as a consequence thereof.

The three circular disc-like members or elements 15, 16 and 17 are enclosed within a tubular sleeve 18 which may be comprised of any suitable material. Each of the members 15, 16 and 17 may be glued or otherwise secured to the inside surface area of the sleeve 18 in unitary assembly thereof to comprise the tobacco tar removal structure.

To effect assembly of the tobacco tar removal structure 12 with the mouthpiece 11 one end of the tobacco tar removal structure is telescoped internally of the tubular mouthpiece 11 and the outersleeve of the tobacco tar removal structure is placed in frictional engagement with the circular mouthpiece surface area 11a. In this respect it will be noted that the mouthpiece 11 is provided with an annular axially facing shoulder 11b disposed radially inwardly of the annular surface 11a. The tobacco tar removal structure when assembled with the mouthpiece 11 is adapted to abut against the annular shoulder 11b.

After the tobacco tar removal structure 12 has been assembled with the mouthpiece 11 the sleeve 13 may then be telescoped over the tobacco tar removal structure 12 into assembly with the mouthpiece 11. To this end, the mouthpiece 11 and the sleeve 13 are each provided with matching stepped surfaces 11c and 13b. When the mouthpiece 11 and the sleeve 13 are engaged together in frictional assembly the external peripheral surface of these elements have a common diameter.

After the mouthpiece 11, the tobacco tar removal structure 12, and the sleeve 13 have been assembled together, a cigarette 19 may be telescoped internally of the internal surface 13a of the sleeve 13 into frictional assembly therewith. It will be appreciated all the components of the holder 10 and the cigarette 19 may be disassembled by reversing the order of the above described steps. Ordinarily the smoker will be able to utilize the tobacco tar removal structure with several cigarettes so that the cigarette 19 will be removed more frequently from the holder than the tobacco tar removal structure.

In order to allow the accumulated tobacco tar T which is collected generally at the impingement barrier 15a to move away from the venturi passageway area 17c spacer structure is provided on the transverse portion 17 as indicated at 17d. It is in this manner that the recessed area 17a may be utilized as a sump for collecting tars.

After the cigarette 19 has been ignited, by applying a suction force to the open end of the mouthpiece 11, smoke may be drawn into the smoke collection chamber 17b and then through the critical sized venturi passageway area 17c whereupon the tars T may be impinged against the impingement barrier 15a with the chamber 17a providing a tar collection sump for the collection of the heavy tars removed from the tobacco smoke. The tobacco smoke after it has struck the impingement barrier area 15a will meander its way through the fibrous circular element 15 and will then flow through the tubular mouthpiece 11 into the mouth of the smoker. It will be appreciated that some of the tar will be collected upon the fibrous material of the element 15 and that after the impingement area 15a has become fully impregnated with tar a certain amount of the tars subsequently removed from the smoke will flow

away from the impingement barrier area 15a and will collect within the sump defined by the recess 17a.

The problem presented previously has been one of providing sufficient smoke flow to satisfy the smoker while at the same time removing the deleterious tars, etc. In the structure of the present invention, this problem is overcome by providing the venturi passageway area 17c with the passage of the smoke stream through the tobacco tar removal structure the venturi passageway area 17c operates to greatly increase the velocity of the smoke stream to approximately 100 feet per second or more so that when the smoke stream strikes the barrier 15a, the tar T is lodged and collected upon the impingement barrier area 15a on the disc 15 in the manner previously described. While there will be variations in the size of the orifice, depending upon the character of the smoke, the density of the cigarette mass, etc. In general effective results are obtained when the orifice diameter is from .025 to .038 (square inch areas of .0005 to .001). Very satisfactory results have been obtained where the orifice diameter is .028 inch to .032 inch (.0006 to .0008 square inch). As a preferred example, I have employed effectively an orifice having a diameter of .030 (.0007 square inch), which gives excellent tars removal and ease of drawing.

The critical orifice size is correlated with the impingement barrier which is located as close as possible to the orifice or venturi outlet consistent with the free flowing of the collected tars; i.e., without impairing the flowing of the tar away from the point of impingement. In practice, I have found that a satisfactory range is a distance of .005" to .030". In the specific example referred to, the impingement barrier 15a is preferably spaced from the orifice or venturi 17c by $\frac{1}{16}$ of an inch (.062"), or approximately twice the orifice diameter.

The operation resulting from the structure shown here-in is in contrast to the operation of cooling devices heretofore employed with cigarettes or cigarette holders. Such cooling devices bring about a peripheral cooling of the smoke but allow substantial core portions of the tars to pass onto the smoker. In my structure, the entire cross-section of the smoke stream is subject to the action of the impingement area 15a so that the tars T and other harmful particles are removed by the foregoing high velocity impingement action upon the barrier 15a. The velocity of the smoke after it passes through the venturi passageway area will exceed 100 feet per second. Of course, the velocity will vary considerably with different smokers and with cigarettes of varying degrees of density.

After the cigarette 19 has been smoked it may be manually pulled from the sleeve 13. After several cigarettes have been smoked the tobacco tar removal structure 12 may be removed by pulling the sleeve 13 out of frictional assembly with the mouthpiece 11 so that the tobacco tar removal structure 12 may be grasped and pulled from the mouthpiece 11. A new tobacco tar removal structure may then be assembled with the mouthpiece 11.

Shown in Figure 4 is a modified construction wherein the reference numeral 21 indicates generally a filter-tip cigarette. The cigarette 21 includes a filter tip 22 comprised of five circular discs or elements 23, 24, 25, 26 and 27 all of which are frictionally engaged at their periphery with an outer sleeve 28 which connects the filter tip 22 to the cigarette 19 since the sleeve 28 may be glued or otherwise fastened or secured with the cigarettes 19. The circular elements 23 and 24 are both comprised of fibrous strands and are much the same type as previously described in the first form of the invention. The circular elements 25 and 26 comprise spacer rings which function to space the transverse passageway blocking portion or disc 27 from the fibrous members 23 and 24. The fibrous member 24 serves as means for preventing tobacco shreds from entering venturi passageway area 27a

which passageway area or orifice extends longitudinally through the disc 27.

When the circular members are in assembly together within the sleeve 28 the ring 26 cooperates with the adjacent circular members 24 and 27 in defining a smoke collection chamber 26a. Similarly, the spacer ring 25 cooperates with the fibrous disc element 23 as well as the transverse passageway blocking portion 27 and defining a tar collection sump 25a. The fibrous strands of the fibrous disc 23 disposed in axially spaced confronting relation to the venturi passageway area 27a comprise an impingement barrier 23a.

Since the dimensional relations have been previously described in connection with the spacing between the venturi and the impingement barrier as well as the cross-sectional area of the venturi passageway area, a further description is not believed to be necessary.

Figure 5 shows the highly simplified manner in which the components of the tobacco tar removal structure may be assembled within the sleeve 28. In this connection it will be appreciated the sleeve 28 may be comprised of any suitable paper-like material and the like as is well known in the art.

Shown in Figure 5 is a third form of the present invention wherein the reference numeral 40 indicates generally a holder structure including a mouthpiece 41 and a cigarette bearing or smokable article carrying member 42.

The holder 40 is provided with a tobacco tar removal structure 43 which includes a circular disc 44 comprised of fibrous strands of the order previously described. Also included in the tobacco tar removal structure 43 is a circular sleeve 45 which engages with the cigarette bearing member 42. In this form of the invention the cigarette bearing member 42 has a circular rear end transverse smoke passageway blocking partition portion 46 which comprises part of the tobacco tar removal structure. It will therefore be appreciated the cigarette bearing member, the circular element 44, and the sleeve 45 together comprise the tobacco tar removal structure 43.

The mouthpiece 41 has an enlarged circular surface area 41a providing a filter socket and a tapered circular surface area 41b with the junction of the surface areas 41a and 41b being separated by an annular axially facing shoulder area 41c. The annular surfaces 41a, 41b and 41c together provide a smoke passageway area indicated generally at 47.

The cigarette bearing member 42 as well as the mouthpiece portion 41 may be comprised of any suitable materials such as thermo-plastic and the like. The circular member 44 may be comprised of cellulose material and the like and the outer sleeve 43 may be comprised of any suitable materials such as a stiff piece of paper or a thin gauge metal.

The cigarette bearing member 42 is of generally cup-shape and has an enlarged recessed area 48 which constitutes a socket for the cigarette 19. The cigarette 19 may be assembled within the socket 48 by telescoping the cigarette butt end internally within the confines of the socket 48. The socket 48 includes a circular surface area 48a as well as an annular axially facing shoulder area 48b and the cigarette is adapted to frictionally engage with the circular surface area 48a and abut in endwise relation against the annular shoulder 48b. Disposed axially of the annular shoulder 48b is a bell-shaped pocket area 49 defining a smoke collection chamber area. The transverse passageway blocking portion 46 is provided with a longitudinally extending venturi passageway orifice 46a of the same type previously described.

Means is provided for spacing the downstream end of the venturi passageway orifice 46a from the circular disc 44 and more particularly its impingement barrier 44a about twice the orifice diameter. To this end, not only does the sleeve 45 engage in spacing relation with

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the member 42 but the cigarette bearing member 42 is provided with a stepper peripheral surface area 42a and the mouthpiece 41 and the sleeve 45 cooperate to provide a second stepped surface area 50. When the stepped surface areas 42a and 50 are engaged with one another when the components of the holder 40 are in assembly this engagement of the stepped surfaces not only operates to maintain the member 42 in assembly with the mouthpiece 41 but in addition limits projection of the member 42 into the filter socket 41a. It is in this manner that a sump area is provided for the collection of tobacco tar. Most of the tars removed as a consequence of the high velocity impingement of the smoke against the smoke impingement barrier 44a will be impregnated on the fibers of the circular disc member 44. However, a certain amount of the tar may collect within the sump 51 and in this manner to some extent operate to lengthen the useful life of the filter disc 44. After several cigarettes have been smoked the filter disc element 44 may be removed from the mouthpiece 41 and a new filter element 44 may be inserted in its place.

During the smoking of the cigarette while using the holder 40 smoke will be allowed to collect in the smoke collection chamber 46 prior to the passage of the smoke through the venturi passageway area 46a. As the smoke is moved through the venturi passageway area 46a its velocity is increased and upon the smoke striking the impingement barrier 44a after the smoke leaves the venturi passageway area 46a tars will be removed from the tobacco smoke in the same manner as previously described. After the smoke has struck the impingement barrier it will then meander its way through the filter element 44 and then flow into the mouth of the smoker.

All of the previously described modifications are provided with a venturi passageway area, a fibrous filter structure having an impingement barrier, and means for spacing the outlet and of the venturi passageway area from the impingement barrier. By maintaining the venturi passageway area spaced from the impingement barrier area the useful life of the filter may be prolonged since a certain amount of the tar will be permitted to collect in the sump between the filter and the transverse smoke passageway blocking portion.

It will be understood that modifications and variations

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may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. A holder for smokable articles, the holder including a mouthpiece having a smoke passage therethrough leading from a filter socket which terminates in an outer end, a smokable article carrying member of generally cup-shape having a socket opening forwardly for removably receiving the butt end of a smokable article and closed at its rear end by a partition having a smoke accelerating orifice of about .0005 to .001 square inch passageway area extending from the member socket to the rear side of the partition, said member having a stepped peripheral surface about its rear end portion of a diameter to fit retainingly into the outer end portion of the filter socket and providing a shoulder engaged by said terminal outer end to limit projection of the member into the filter socket, a removable filter element supported in said filter socket and providing a completely closed barrier between said passage and said orifice, and means maintaining the filter element in a spaced relation to said orifice of about twice the diameter of the orifice to compel direct impingement at high velocity onto the filter element barrier of all smoke drawn through the orifice to deposit tars onto the barrier, the smoke then passing through the filter element into said smoke passage of the mouthpiece.

2. A holder as defined in claim 1, wherein said means maintaining the filter element in spaced relation comprises a spacer flange projecting forwardly from the periphery of the filter element and into engagement with the rear end portion of the article carrying member.

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