

[54] **FILTER APPARATUS FOR REMOVING TAR AND OTHER DELETERIOUS SUBSTANCES FROM TOBACCO SMOKE**

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[51] Int. Cl. A24f 13/06

[58] Field of Search..... 131/10.5, 187, 210, 131/261 B

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[57] **ABSTRACT**

Apparatus is disclosed for removing tars and other deleterious material from tobacco smoke including a cylindrical housing including an entrance chamber for receiving the tobacco product, such as a cigarette, and terminated at the inner end by a disk having a selected number of apertures therethrough for the passage of tobacco smoke. Further, channels are disposed within the disk to direct the flow of smoke from the end of the tobacco product into the apertures. An annular smoke guide is disposed on the rearward side of the aforementioned disk to present an edge onto which the smoke is directed by the disk apertures, whereby the tars and various deleterious products may be deposited. Further, the smoke is further drawn through a porous filter, whereby any remaining deleterious products may be absorbed. Such filter apparatus may be mounted within a holder including a mouthpiece having a passage therethrough in communication with the aforescribed filter apparatus. In one illustrative embodiment, the mouthpiece is connected to a resilient bushing and is resiliently biased against an end of the filter apparatus to assure that air does not leak about the outer surface of the tobacco product and filter apparatus. In addition, the holder includes a cavity for mounting therein the filter apparatus and for facilitating the rectilinear movement of the mouthpiece to thereby enable the aforescribed filter apparatus to be ejected therefrom. In one illustrative embodiment, the cigarette receiving opening of the cavity has therein a resilient holding projection for securing the filter apparatus within the cartridge, but permitting upon actuation of the mouthpiece member, the rejection therethrough of the filter apparatus.

7 Claims, 6 Drawing Figures

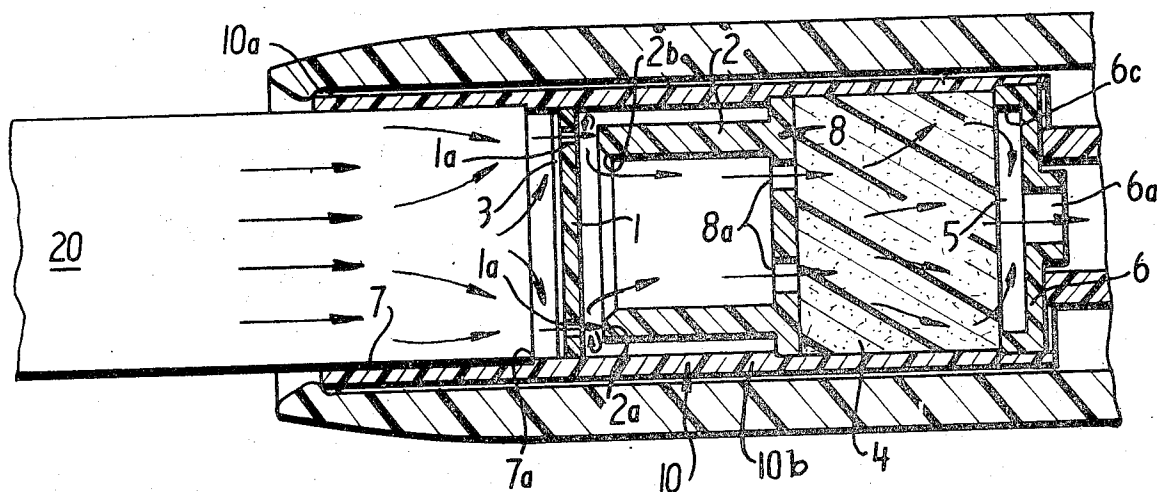


FIG. 1

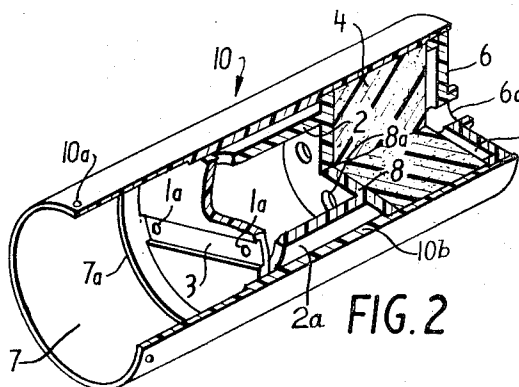
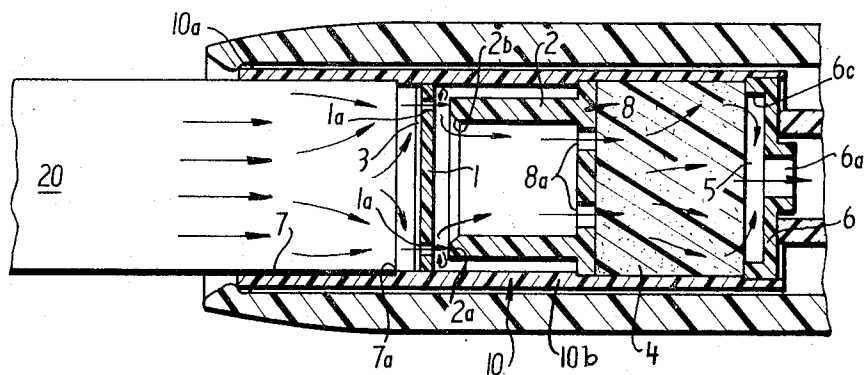


FIG. 2

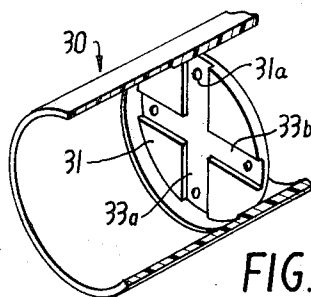


FIG. 3

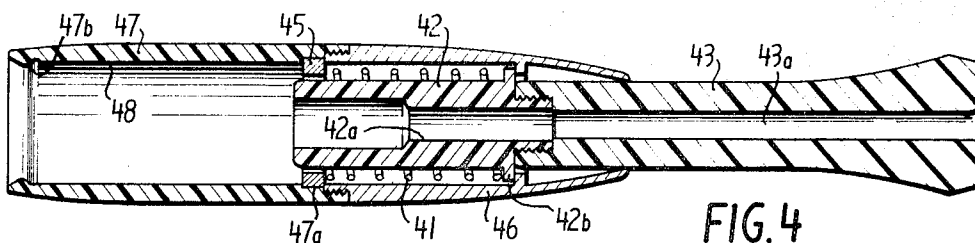


FIG. 4

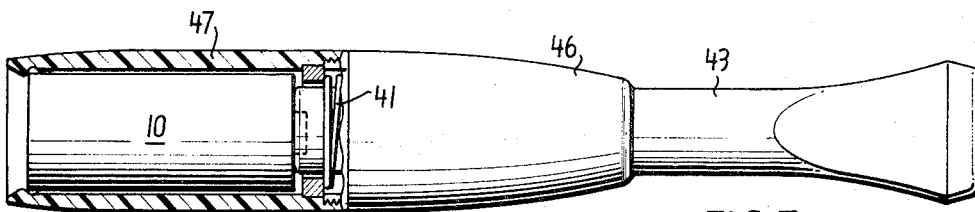


FIG. 5

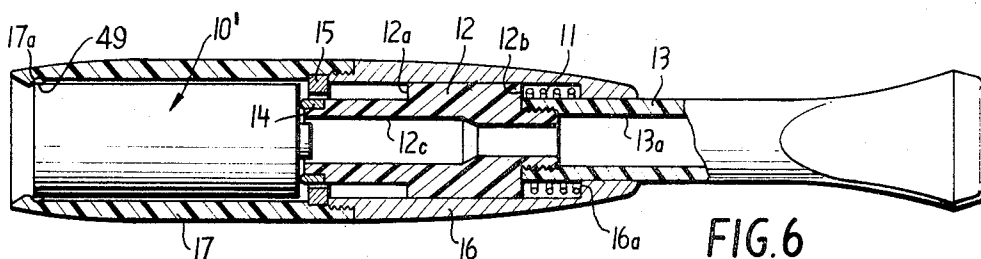


FIG. 6

FILTER APPARATUS FOR REMOVING TAR AND OTHER DELETERIOUS SUBSTANCES FROM TOBACCO SMOKE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to filter apparatus and particularly those filter apparatus adapted to be incorporated into cigar or cigarette holders.

2. Description of the Prior Art

In the prior art, cigarette and cigar filter devices are known for withdrawing various deleterious substances, such as tar, from the tobacco smoke before being inhaled. Typically, atmospheric air contains more or less humidity, depending upon the humidity of the ambient environment. As the air is drawn through the burning tobacco, the relatively high temperature of the tobacco transforms this moisture into aqueous vapor. Simultaneously, the combustion of the tobacco produces certain by-products including nicotine, tars, resins, ash in the form of dust, and other deleterious products. The nicotine, tars and resins and other volatile constituents of these products of combustion are volatilized in the combustion zone, and in the normal operation of smoking, without appropriate filter apparatus, they would be carried by the tobacco smoke and aqueous vapor directly into the mouth, throat and lungs of the smoker, where they condense or liquefy in the form of a dark brown, mobile liquid.

In the past several years, the public has become deeply concerned over the possible injurious effects of the combustion products from tobacco. This concern has spurred the development of various tobacco filtering apparatus to absorb to the degree possible these deleterious products. The use of filters of absorbent material heretofore employed, may remove some small part of these products of combustion by absorption. However, the passage of such products through these absorbent filters is so rapid and unobstructed that they are extremely inefficient and a very considerable quantity of the deleterious products may enter the mouth of the smoker.

Other devices have been devised for the filtering of tobacco smoke to remove the aforementioned products. Screens and orifice-equipped disks have been proposed, the effective opening for the flow of smoke being quite minute; while some of the aforementioned products may be removed thereby, it would be desirable to improve the efficiency of such devices by first increasing the proportion of deleterious products removed and further permitting a satisfying flow of smoke through the filter device. Many filter devices now proposed obstruct the flow of air and smoke therethrough to such an extent that the smoker is forced to inhale with undue effort.

Further, there has been suggested suitable filter holders for accepting filter devices of the prior art whereby the filter holder may be re-used by inserting new filters. Typically, it would be desirable if such filter holders could readily accept a replaceable filter apparatus, and then after use and the filter has become clogged with the removed tobacco products, the filter apparatus could be replaced readily.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a new and improved filter apparatus capable of effi-

ciently removing deleterious products from tobacco smoke, while permitting a relatively easy flow of air through the filtering apparatus.

It is a further object of this invention to provide a new and improved filter holder device capable of readily receiving and discharging a filter apparatus therefrom.

In accordance with these and other objects of the invention, there is provided filter apparatus adapted for efficiently removing the deleterious products from tobacco smoke, including a housing having at one end thereof an entrance chamber for receiving the end of a tobacco product such as a cigarette, a disk terminating the entrance chamber and having therein a plurality of openings to permit the passage of smoke therethrough, and an annular guide member disposed about the axis of the housing for presenting an edge surface to the aforementioned openings upon which the deleterious products may be deposited. In an illustrative embodiment of this invention, a porous filter may be disposed rearwardly of the annular guide member to form a further filtering operation upon the tobacco smoke.

As a further aspect of this invention, the disk may have channels or grooves disposed therein for directing the tobacco smoke into the disk openings and decreasing the depth or width of the openings to prevent clogging by the deleterious products. The edge of the annular guide member may have a beveled portion whereby the build-up of deposit upon the peripheral edge will not block the flow of tobacco smoke through the disk openings. Further, the annular guide member facilitates the flow of tobacco smoke through the filter housing.

A still further aspect of this invention involves the use of the aforementioned filter with a filter holder having an outer housing and an inner mouthpiece disposed for rectilinear motion with respect to the aforementioned housing. The outer housing has a cavity therein for receiving the aforescribed filter apparatus so that the entrance cavity of the filter apparatus is disposed to receive a cigarette or the like through an opening within the outer housing. The inner mouthpiece may then be moved toward the forward end to thereby eject the filter apparatus therefrom once the filter apparatus has been spent by collection of deleterious tobacco products.

In one illustrative embodiment of the filter holder of this invention, spring-biasing means are incorporated to urge the inner mouthpiece as described above against one end surface of the filter apparatus to insure an air-tight seal therebetween, to prevent air from flowing about the filter apparatus and into the central passage of the mouthpiece. In a further embodiment of this invention, the inner mouthpiece may have a resilient bushing disposed about the inner passage to insure an air-tight seal between the inner mouthpiece and the filter apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will become more apparent by referring to the following detailed description and accompanying drawings, in which:

FIG. 1 is a partial, cross-sectioned view showing the filter apparatus as incorporated into a holder in accordance with the teachings of this invention;

FIG. 2 is a partial perspective view, partially broken away, showing the filter apparatus of FIG. 1;

FIG. 3 is a partial perspective view partially broken away, of an alternative embodiment of the filter apparatus of this invention in which four openings are disposed within the inner disk member thereof;

FIG. 4 is a sectioned view of a cigarette holder for receiving the filter apparatus as shown in FIGS. 1, 2 and 3, in accordance with teachings of this invention;

FIG. 5 is a side elevational view partially in section illustrating the cigarette holder of FIG. 4; and

FIG. 6 is a sectional view of another embodiment of the filter holder of this invention whereby a seal is insured between the inner mouthpiece thereof and the filter apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With regard to the drawings and in particular to FIG. 1, there is shown a tobacco smoke filter in accordance with the teachings of this invention including an outer, cylindrical housing 10 having an entrance through which a cigarette 20 may be inserted into an entrance chamber 7. As indicated in FIG. 1, the housing 10 forms a circular ridge 7a against which the edge of the cigarette 20 abuts. The entrance cavity 7 is terminated by a disk 1 extending across and blocking the flow of tobacco smoke through the housing 10. As particularly illustrated in FIG. 2, the disk 1 has a groove or channel 3 disposed thereacross for directing the tobacco smoke into at least two openings, 1a disposed at either end of the channel 3. Significantly, the provision of the channel 3 reduces the depth or axial dimension of the openings 1a through the disk 1 to thereby reduce the possibility of clogging the disk openings 1a with the deleterious particles. If the depth of the openings 1a is larger, the openings 1a are liable to be filled with a deposit of tobacco products and further, the removal of such deposit by oral suction would become difficult. In an illustrative embodiment of this invention, the depth or axial dimension of the openings 1a is 0.6mm with a 0.6mm diameter.

As shown in FIG. 2, two openings 1a are provided. However, it will be understood as shown in FIG. 3, that a greater number of openings may be provided. For example, FIG. 3 shows a filter apparatus having a cylindrical housing 30 in which there is disposed a disk 31 having a pair of grooves or channels 33a and 33b disposed at right angles with respect to each other within the disk 31, with two openings 31a disposed in each channel.

With regard to FIGS. 1 and 2, an annular smoke guide 2 is disposed about the axis of the cylindrically-shaped housing 10 rearwardly of the disk 1. More specifically, the smoke guide 2 has a circular edge portion 2a aligned in an axial sense with respect to the openings 1a it being noted that the forward edge of the guide 2 is spaced slightly rearwardly from the rear face of the disk 1. In the embodiment shown in FIG. 3, a similar smoke guide would be disposed rearwardly of the disk 31 having an edge portion disposed in alignment with each of the openings 31a. As particularly shown in FIG. 1, the smoke guide 2 has a beveled portion 2b, the function of which will be explained in detail later. As illustratively shown in both FIGS. 1 and 2, the smoke guide 2 is mounted upon a disk 8 disposed across and blocking the interior of the cylindrical housing 10. The disk 8 has a plurality of openings 8a therein disposed in a circular array centrally of the disk 8 and through which

the annular smoke guide 2 directs the tobacco smoke as the smoker inhales.

A further stage of filtration is provided by a porous filter 4 disposed rearwardly of the disk 8. The filter 4 may be made of a suitable porous material for absorbing those deleterious products which have not already been removed by the filtering process effected by the smoke guide 2. As seen in FIG. 1, a circular end member 6 closes off the end of the filter apparatus and includes a flange 6c abutting the end portion of the porous filter 4, for retaining the porous filter 4 within the housing 10 against the disk 8. The flange 6c forms an open cavity 5 on the rearward side of the porous filter 4 to thereby increase the effective area of the filter by increasing the area through which the smoke may flow from the end surface of the filter 4. As shown in FIG. 1, an opening 6a within the end member 6 is provided in communication with the cavity 5 to permit the exit of the tobacco smoke.

In operation, the tobacco smoke is withdrawn as shown by the arrows in FIG. 1 from the cigarette 20 and is directed by the channels 3 into the openings 1a of the disk 1. The constricted openings 1a force the tobacco smoke into jets which are directed onto the circular edge portion 2a, whereat tars, nicotine and other deleterious products are deposited. Further, the plural openings 1a encourage a high-speed venturi effect which spins the tobacco smoke to centrifugally throw the heavy tar, nicotine and moisture onto an inner wall surface 10b. As indicated by the arrows in FIG. 1, the tobacco smoke is not drawn into the space between the smoke guide 2 and the inner wall surface 10b, but tends to return into the central passageway within the annular smoke guide 2 to be drawn through the openings 8a of the disk 8. As illustrated in the embodiments of FIGS. 1, 2 and 3, more than one opening 1a is provided. If only one opening is provided, the deposit from the tobacco smoke will be only a small portion of the edge 2a and the available area for deposit will not be used effectively.

Significantly, the circular edge 2a has a beveled edge portion 2b on the inside thereof to facilitate the collection of deposit thereon whereby the deposit does not back up and block the openings 1a. It is particularly noted that the removal of deleterious products is by a multiple process including not only the bombardment of the surface portion 2a, but also the spinning of the air by the mechanism of the disk 1 and the openings 1a therein, whereby products are thrown against the surface 10b.

With regard to FIGS. 4 and 5, there is shown a filter holder in accordance with teachings of this invention for receiving any of the filter apparatus as shown in FIGS. 1, 2 and 3. More specifically, there is shown an outer housing 46 of a generally cylindrical, tapered configuration for receiving therein an inner mouthpiece 43 having a central passage 43a disposed there-through. As indicated in FIG. 4, the mouthpiece 43 is coupled by suitable threads to an inner guide tube 42, likewise having an inner passage 42a therethrough in alignment with the passage 43a of the mouthpiece 43. The outer housing 46 is in turn connected, as by screw threads, to a cylindrically-shaped member 47 forming a chamber 48 for receiving the filter apparatus as described above. Significantly, a spring-biasing member 41 is incorporated within this filter holder for biasing the guide tube 42 to the right, as shown in FIGS. 4 and

5. More specifically, the guide tube 42 includes a circular projection 42b against which one end of the spring 41 abuts. Further, an annular member 45 is disposed within a circular groove 47a of the cylindrical member 47 to retain the other end of the spring 41. The cylindrical member 47 includes a projection or notch 47b for retaining the filtering apparatus within the cavity 48 with its discharge opening 6a in communication with the inner passage 42a of the guide tube 42. The filter apparatus may be easily inserted within the member 47 by pressing the filter apparatus which may be made typically of a suitable flexible plastic, through the entrance opening of the member 47 past the circular notch 47b, whereby the notch 47b abuts and retains the leading edge of the filtering apparatus. In order to discharge the filter apparatus, the mouthpiece 43 is grasped and is directed to the left, as shown in FIGS. 4 and 5, to thereby cause the guide tube 42 to abut the disk 6 and to force the filter apparatus through the front opening of the member 47.

In the embodiment of the filter holder shown in FIGS. 4 and 5, the filter apparatus is not resiliently secured within the holder, but is disposed within the opening formed by the member 47 which is dimensioned axially to receive a filter apparatus of like dimension. Therefore, a gap between the filter and the holder may sometimes occur because of dimensional errors of the filter and/or the holder. In a further embodiment of this invention as shown in FIG. 6, a suitable biasing means such as a coil spring 11 is inserted within the filter holder to direct a guide tube 12 toward the end surface of the filter apparatus whose housing is indicated by the numeral 10. More specifically, the guide tube 12 includes a surface 12b against which one end of the spring 11 abuts and the outer housing 16 of the holder includes a second surface 16a against which the other end of the spring 11 abuts so that the spring 11 provides a biasing force against the guide tube 12 in a direction to the left, as shown in FIG. 6. The guide tube 12 includes an annularly-shaped, resilient bushing 14 disposed at one end thereof for abutting against the end surface of the filter. The biasing action of the spring 11 and the resiliency of the bushing 14 insure an airtight seal between the guide tube 12 and the filter apparatus whereby air cannot seep around the filter apparatus and into a central passage 12c of the guide tube 12.

The leading or other end of the filter apparatus is retained within a cylindrical member 17 which is attached to the outer housing 16, by a circular projection 17a which abuts against a series of detents 49 disposed upon the periphery of the filter apparatus housing 10'. In the embodiment shown in FIG. 6, the biasing force of the spring 11 is smaller than the stopping force of the projection 17a, as exerted upon the detents 49.

In order to remove the filter apparatus, a mouthpiece 13, which is connected with the guide tube 12, is directed strongly to the front direction or left, as shown in FIG. 6, to disconnect the detents 49 from the rim 17a, whereby the filter apparatus is discharged from the cylindrical member 17. In this step, the rectilinear movement of the guide tube 12 with respect to the outer housing 16 is limited by an annularly shaped stopper member 15 disposed within a groove of the cylindrical member 17, which abuts against a surface 12a of the guide tube 12. The biasing action of the spring 11 compensates for dimensional error either in the filter

holder or the filter apparatus. In an illustrative embodiment of this invention, the stroke of the rectilinear motion of the guide tube 12 is in the order of 5mm, which is sufficient for the compensation of normal dimensional errors in the length of the cartridge or filter holder. Further, the cylindrical member 17 may be made of a wear-resistant material such as a suitable metal, e.g., aluminum, to insure that the repeated rejection of the filter apparatus does not have a harmful effect upon the life of the filter holder.

Thus, there has been shown a new and improved filter apparatus capable of efficient removal of deleterious particles from tobacco smoke by a plurality of filtering actions in which: (1) a swirling action may be imparted to the filter smoke, whereby deleterious particles are centrifugally thrown therefrom, (2) a plurality of jets of the smoke particles are directed onto an impact surface and (3) a porous filter is used to remove any remaining particles that may be left. Further, there is shown a new filter holder for such filter apparatus whereby the insertion and removal of the filter apparatus is easily achieved.

Numerous changes may be made in the above-described apparatus and the different embodiments of the invention may be made without departing from the spirit thereof; therefore, it is intended that all matter contained in the foregoing description and in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Tobacco smoke filtering apparatus comprising:

a. a housing member defining a smoke passage there-through;

b. a barrier disposed within said housing member at a forward portion thereof and across said smoke passage, said barrier defining at least two openings therein for forming jets of tobacco smoke; and

c. an annular member disposed within said housing member rearwardly of said barrier, said annular member having an edge surface disposed in axial alignment with said openings whereby deleterious substances carried by the tobacco smoke are deposited upon aligned portions of said edge surface.

2. Filtering apparatus as claimed in claim 1, wherein said annular member is mounted upon a support member disposed across said smoke passage, said support member having an opening therein to permit the passage of smoke through said annular member and said support member opening.

3. Filtering apparatus as claimed in claim 2, wherein an absorbing, porous filter is disposed within said housing member rearwardly of said support member to provide a further filtering action upon those deleterious substances not deposited upon said edge surface.

4. Filtering apparatus as claimed in claim 3, wherein there is included an end member disposed remotely of said porous filter, said end member defining a cavity between said end member and said porous filter, whereby a substantial portion of an end surface of said porous filter is exposed to said cavity, said end member including an opening in communication with said cavity.

5. Filtering apparatus as claimed in claim 1, wherein said barrier includes a channel disposed therein in communication with said two openings for directing the smoke therethrough.

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6. Filtering apparatus as claimed in claim 5, wherein there is included a second channel disposed in said barrier substantially at right angles with said first-mentioned channel and in communication with a second pair of openings through said barrier.

7. Filtering apparatus as claimed in claim 1, wherein

said annular member has a bevel adjacent said edge surface for preventing the build-up of a deposit of deleterious substances that would block said openings within said barrier.

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