The present invention relates generally to cigarette structures and a method of manufacturing the same. More specifically, the present invention relates to a filter tip construction and the method of manufacturing the same whereby the filter tip is provided with a venturi passageway area intermediate its length so that the velocity of smoke passing through the filter tip may be accelerated and tars in the smoke may be impinged upon fibers of the filter tip in a new and improved manner.

The majority of present day filter-tip cigarettes use cellulose filaments in varying amounts with various binders and additives. However, in spite of the use of many thousands of fine filaments, the filter tips still have considerable air space between the filaments for a 5/8" diameter filter tip can be compressed into a 3/16" diameter rod or bundle, that is, a reduction in cross-sectional area from approximately 0.07 square inch to 0.01 square inch or the equivalent of an air passage of approximately 0.06 square inch or 9/32" diameter. Such a large air passage is in marked contrast to the 1/32" inch or less orifice used to create high velocity-impingement tar collection according to the principles of my invention as set forth in my earlier filed compounding application. In this respect, the present application is a continuation-in-part of my compounding application, Serial No. 662,049, filed May 28, 1957, for Removal of Tar and Other Delterious Substances From Tobacco Smoke.

It is clear that the conventional filter tip trap or collect the smoke as they do stop by filters formed from the filaments and the circumjacent path the smoke travels in passing along the length (approximately 9/32") of the filter tip.

In contrast to the above conventional filter tips the same fibrous stranded or cellulose stranded filter tip can be made to function as a Venturi-impingement tar remover by constricting a narrow zone or section of the filter tip according to certain principles of my invention in the present application so that the aggregate of the air spaces left through the constricted area or zone will approximate a 5/32" diameter hole. Then as smoke is drawn through the constricted area or zone it will be greatly accelerated and then impinged on the barrier formed by the relatively loose packed filament confrontingly disposed downstream thereof with the tars thereby being extracted.

According to the present invention the principal object is to form a critical sized smoke passage or venturi which will speed up the smoke to a terrific velocity exceeding, e.g., one hundred feet per second so that the heavy (high temperature formed) tar molecules or particles will not be able to meander their way through the remaining relatively loose packed strands of filter material, but will, instead, impinge against and come to rest on the strands or filaments of filter tip material that confront or stand in their high speed, straight line path from the venturi passage. The lighter weight aromatic, low temperature formed smoke particles or fractions which go to make up a safe, enjoyable smoke will change their high speed straight line path to conform to the devious paths formed by the spaces between the relatively loosely packed filaments that make up the filter tip.

Expansion cooling of tobacco smoke requires 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 filter tip may be kept to a minimum since the expansion chamber is not required and the dimensions of the conventional filter tips may remain substantially unaltered despite the inclusion of the critical passage area. Another advantage of the present invention is that a standard, conventional filter tip may be utilized and its method of manufacture may be varied to slightly as to incorporate in the conventional filter tip the critical passage area as noted above.

If the conventional filter tip is provided with a venturi passageway area according to the principles of the present invention before it is attached with the cigarette proper, the attaching wrapper or paper will hide the construction so that the finished cigarette will appear identical to a conventional filter tip cigarette. This resemblance in appearance is the only similarity, however, since upon being tested by the smoker the improved taste will be immediately noted and if the filter tip is broken open after the cigarette has been smoked, the reason for the improved smoke will also be readily apparent in the substantially increased amount of tar accumulation therein.

If the filter tip construction is manufactured with an air passage area, for example, equivalent to an 0.08"-0.09" diameter hole, all the tar regarded harmful by modern medical thinking will be deposited that is, impinged on the filter tip filaments.

The present filter tip construction when comprised of some suitable substance such as cellulose has between its opposite ends an intermediate fused area with the opposite ends being linked by the critical passageway area through the intermediate fused area. The filter tip fibers downstream of the passageway operate as an impingement barrier against which the smoke strikes at velocities exceeding 100 feet per second after passing through the critically passageway area.

The filter-tips may be provided with the critical passageways area by, for example, hot rolling the intermediate portion of the filter tip blank causing the diameter to be reduced and with the heat fusing the cellulose fibers.

Accordingly, an object of the present invention is to provide a new and improved highly economical method of manufacturing filter tip elements and filter tip cigarettes.

Still another object of the present invention is to provide a new and improved filter tip construction which is highly economical.

Yet another object of the present invention is to provide a filter tip construction and method of manufacture which may be carried out so as to enable efficient large scale mass production of the same.

Other objects and features of the present invention will more fully become apparent in view of the following detailed description taken in conjunction with the accompanying drawings illustrating therein a single embodiment and in which:

Figure 1 is a fragmentary cross-sectional schematic view of my method of manufacturing filter tips for cigarettes;

Figure 2 is an enlarged fragmentary cross-sectional view, partially in elevation, of a fibrous length of filter tip material as shown in Figure 1;

Figure 3 is an enlarged fragmentary cross-sectional view taken substantially on the line III-III of Figure 2 looking in the direction indicated by the arrows;

Figure 4 is an enlarged fragmentary cross-sectional view.
view of a filter tip according to the principles of this invention;

Figure 5 is an enlarged cross-sectional view taken substantially in the line V-V of Figure 4 looking in the direction indicated by the arrows; and

Figure 6 is an enlarged cross-sectional view similar to Figure 4 only illustrating the filter tip in assembly with a cigarette and after the cigarette has been at least partially smoldered. The reference numeral 10 in Figures 4 and 5 indicates generally a filter tip manufactured according to the principles of the present invention.

In Figure 6 a cigarette is indicated at 11 which cigarette is of the filter type and has the filter tip 10 in assembly therewith. The filter tip may be manufactured from any suitable materials such as cellulose, other fibrous materials, and the like. In Figure 1 a mass of fibrous material 12 is disposed upstream of an extruder mechanism 13 with the fibrous material being actuated or forced through the extruder mechanism 13 in a manner whereby a length or strip 14 of fibrous materials such as cellulose is extruded which strip has a reduced cross-sectional dimension.

Downstream of the extruder 13 is a mechanism 15 for reducing the cross-sectional dimension of the strip 14 at predetermined instances along the length of the strip. In the illustrated form the mechanism 15 is suitably shown as comprising deform roll pairs 15a and 15b which are preferably heated along with a roller mechanism portion 15c which serves to support the rollers 15a and 15b. This heated roller mechanism serves to constrict the diameter of the strip and operates to fuse predetermined areas on the strip of material as will hereinafter be described in further detail.

The extruder 13 has a bell-shaped passageway 13a and a spider 16 is mounted within the reduced diameter area of the passageway which spider 16 supports a wire 17 of predetermined critical size.

Each filter tip includes opposite end portions 10a and 10b which are separated from one another by an intermediate fused portion 10c which has a reduced cross-sectional dimension or area as compared to the opposite end portions 10a or 10b. Extending longitudinally of the reduced intermediate fused portion 10c is a longitudinal passageway area or passage 10d which passage allows smoke to pass from an upstream end 10e of the filter tip to the downstream end 10f and then into the mouth of the smoker. The opposite end portions 10a and 10b each have annular peripheral fused areas 10e which operate to confine the smoke internally of the fused area 10e of the filter tip 10.

Each of the opposite end portions 10a and 10b is comprised of a multiplicity of fibers 10f with the fibers on the downstream side of the passageway 10d providing an impingement barrier for the accumulation of tar particles as indicated at T in Figure 6.

According to the method aspects of the present invention, the extruder mechanism operates to extrude a stream or strip of fibrous material having an internal longitudinally extending passageway 14a created by the wire or rod 17. As the strip of material passes from the extruder roller mechanism 15 construits the strip forming annular grooves or depressions 14b therein. By virtue of the fact the roller mechanism 15 is heated the peripheral areas of each strip segment 14c is fused. Also, since the rollers 15c are heated and further since the rollers operate to constrict the material between the segments 14c, link strip portions 14d are internally fused throughout except the area where the passageway 14a extends longitudinally therethrough.

Downstream of the extruder mechanism 15 is provided a cut-off mechanism 18 to avoid interference therewith. It will also be noted that since the fibrous material remains in a flexible relatively spongy state after each filter tip 10 has been cut from the strip, the portion 10e of the passageway 14a extending the length of the strip sections 14c, or the opposite filter tip end portions 10a and 10b, are closed. Since the intermediate linking portion of the filter tip is fused, the longitudinal passageway 10d remains therethrough after the filter tips 10 have been cut from the strip 14.

Each of the filter tips 10 is preferably peripherally sealed in order to preclude the smoke from bypassing the longitudinal passageway 10d and jumping across the gap between the opposite end portions 10a and 10b at the outer periphery of the reduced diametered area 10c. As has been discussed above, the filter tip 10 may be heat glazed to fuse the peripheral surface or the peripheral surface of each of the filter tips may be provided with a coated seal such as by spray painting or the like. In any event, the linking or intermediate portion 10c should be preferably substantially solid except for the passageway area 10d extending therethrough so the velocity of the smoke passing through the filter tip may be effectively increased.

Each of the filter tips may be suitably provided with a peripheral layer comprised of paper or some other suitable material which layer is indicated generally at 19 in Figure 6. The peripheral layer 19 as illustrated comprises a tubular member and extends across the depressed area of the filter tip so that the filter may have a conventional tubular appearance. Each of the filter tips is then abutted against a cigarette 20 and a paper piece 21 is wrapped around the periphery of the filter tip 10 and the cigarette 20 to connect them together (Figure 6) to form a filter tip assembly.

In the past, the problem presented 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 a venturi orifice or passageway which greatly increases the velocity of the smoke stream passing through the filter tip so that when the stream strikes the barrier comprised of a multiplicity of fibrous strands such as cellulose, the tar is lodged and collected upon the peripheral surface of the fibrous strands and the resulting purified smoke enters the smoker's mouth. Also, the passage of the purified smoke through the downstream end 10e of the filter tip 10. In addition, the presence of the filter tip 10 aids in the removal of the tar or "tars" should be regarded as embracing tars, resins, and other harmful substances. 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 where 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" to .032" (.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 tar removal and ease of drawing.

The operation resulting from the structure shown herein is in contrast to the operation of cooling devices hereinafter employed with cigarettes where a relatively large expansion chamber is required. Such cooling devices bring about a peripheral cooling of the smoke but allow substantial core portions of the tars to pass onto the smoker without the tars being removed therefrom. In the present structure, the entire cross-section of the smoke stream is subject to the action of the impingement barrier comprising the passageway end 10e of the filter tip so that the tars and other harmful particles are removed by the foregoing high velocity impingement action upon the barrier.

The passage or orifice is effective in greatly increasing the velocity of the smoke so that it is substantially
in excess of 100 feet per second. If more than one orifice is used the total square inch area should fall within the range given. In this case the method of manufacture may be altered since one or more additional wires may be sustained within the stream of filter tip material in the formation of the orifices or passages in the intermediate fused area to enable the square inch area to fall within the range given. Of course, the velocity will vary considerably with different smokers and cigarettes of varying degrees of density. By positioning the barrier in confronting relation to the outlet of the orifice, the attained high velocity is effective in lodging the tar fractions directly upon the strands of filter tip material thereby removing them from the smoke.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

4. A method of manufacturing filter tips for cigarettes comprising extruding a length of cellulose fibers, at selected intervals reducing the diameter of localized areas along the length of the cellulose fibers by compacting the cellulose fibers to a predetermined diameter at the localized area, where the diameter has been reduced, forming a venturi passageway of about .025"-.036" diameter, and dividing the length of cellulose fibers into a series of filter tips for cigarettes each having one of the venturi passageways.

5. A method of manufacturing filter tips for cigarettes comprising extruding a stream of cellulose fibers, at selected intervals reducing the diameter of localized areas along the length of the cellulose fibers by compacting the cellulose fibers to a predetermined diameter at the localized area, where the diameter has been reduced, forming a venturi passageway of about .025"-.036" diameter through the localized area where the diameter has been reduced, and dividing the stream of cellulose fibers into a series of filter tips for cigarettes each having one of the venturi passageways.

6. A method of manufacturing filter tips for cigarettes comprising extruding a stream of cellulose fibers, at selected intervals reducing the diameter of localized areas along the length of the cellulose fibers by compacting the cellulose fibers to a predetermined diameter at the localized area, where the diameter has been reduced, forming a venturi passageway of about .025"-.036" diameter and with the venturi passageway operating to accelerate the smoke velocity in excess of 100 feet per second during drawing of smoke therethrough.

7. A filter tip for a cigarette comprising a length of cellulose fibers having a limited area intermediate their length being compressed and fused together and with a smoke passageway through the fused fibers linking opposite end portions of the filter tip and providing a single hole having a diameter approximating .025"-.036" diameter.

8. In combination, a cigarette and a filter tip in assembly therewith and with the filter tip comprising a length of fibrous material having a total obstruction intermediate its length except for a single venturi passageway therethrough and with the length of fibrous material including a fibrous area on the downstream side comprising an impingement barrier, said venturi passageway being dimensioned for smoke passage therethrough at a velocity in excess of 100 feet per second against the impingement barrier to remove the relatively heavy tars contained in the smoke impinged upon the impingement barrier thereby removing them from the smoke stream.

9. A method of manufacturing a filter tip for cigarettes comprising reducing the diameter of a length of fibrous material by compacting the fibrous material constituting a filter tip providing a smoke impervious localized area along the length thereof, contemporaneously setting up internal forces along the length of the area being compressed resisting compression and thereby forming a longitudinal venturi passageway of about .025" to .036" diameter extending longitudinally through said localized area of the filter tip for confining a smoke stream to travel at high velocity therethrough, assembling the filter tip and a cigarette in end-to-end relation, and wrapping a length of material about the filter tip and the cigarette connecting them together in assembly.

References Cited in the file of this patent

UNITED STATES PATENTS

987,359 Guenifet et al. Mar. 21, 1911
1,555,520 Well Sept. 29, 1925
1,616,851 Geisler Feb. 8, 1927
1,983,926 Zirmer Dec. 11, 1934
1,989,130 Brown Jan. 29, 1935
2,246,929 Seney June 24, 1941
2,349,551 Helm May 23, 1944
2,511,898 Brothers June 20, 1950
2,705,013 Brothers Mar. 29, 1955
2,769,533 Booth Nov. 6, 1956
2,794,480 Crawford et al. Jan. 4, 1957
2,780,573 Davidson Feb. 5, 1957
2,820,460 Bunz Jan. 22, 1958
2,869,883 Dunbar Jan. 20, 1959

FOREIGN PATENTS

188,091 Germany Jan. 27, 1907