United States Patent [19]

Westcott et al.

[11] **3,888,160**

[45] **June 10, 1975**

[54] **TOBACCO SMOKE FILTER**

[75] Inventors: **David Thomas Westcott; Geoffrey Roger Woodman,** both of Bristol, England

[73] Assignee: **Imperial Tobacco Group Limited,** London, England

[22] Filed: **Aug. 31, 1973**

[21] Appl. No.: **393,591**

Related U.S. Application Data

[62] Division of Ser. No. 217,797, Jan. 14, 1972, Pat. No. 3,791,265.

[30] **Foreign Application Priority Data**

Feb. 1, 1971 United Kingdom..... 3550/71

[52] **U.S. Cl.** ..... **93/1 C;** 93/77 FT; 131/261 B

[51] **Int. Cl.** **A24c 5/50**

[58] **Field of Search** ..... 93/1 C, 77 FT; 131/261 R, 131/261 A, 261 B, 10.5, 11, 12, 13, 14

[56] **References Cited**

UNITED STATES PATENTS

3,354,887	11/1967	Hall	93/1 C X
3,625,228	12/1971	Dock	131/261 A
3,685,523	8/1972	Labbe	131/261 B

FOREIGN PATENTS OR APPLICATIONS

1,086,443	10/1967	United Kingdom	131/14
278,534	10/1927	United Kingdom	131/13

Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan
Attorney, Agent, or Firm—Larson, Taylor & Hinds

[57] **ABSTRACT**

A tobacco smoke filter is in the form of a cylinder having a low resistance core and a high resistance end wall which cause smoke flow radially through the cylinder wall. The filter is preferably made by compacting the central core of a filter plug to form the dense end wall. Such filter plugs have an efficiency of 2 or 3 times that of a conventional filter of the same pressure drop.

8 Claims, 15 Drawing Figures

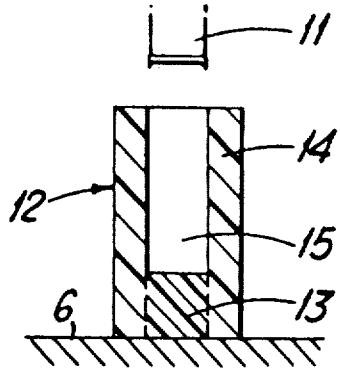


Fig. 1.

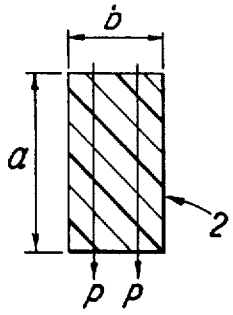


Fig. 2.

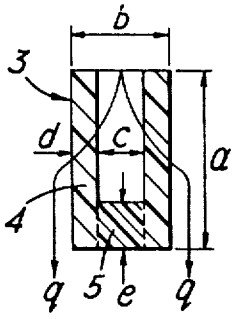


Fig. 3.

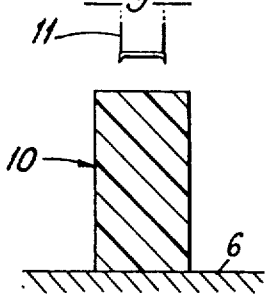


Fig. 4.

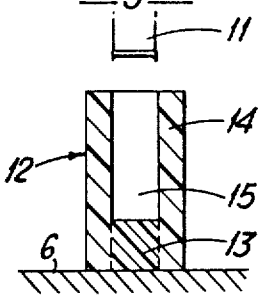


Fig. 5.

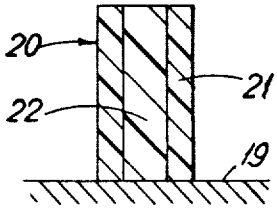


Fig. 6.

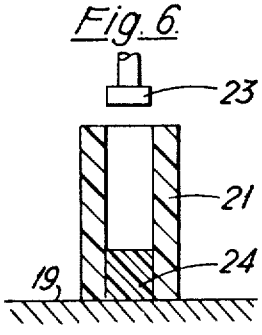
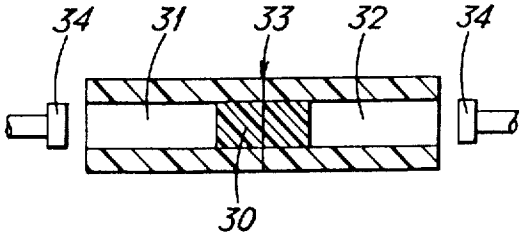


Fig. 7.



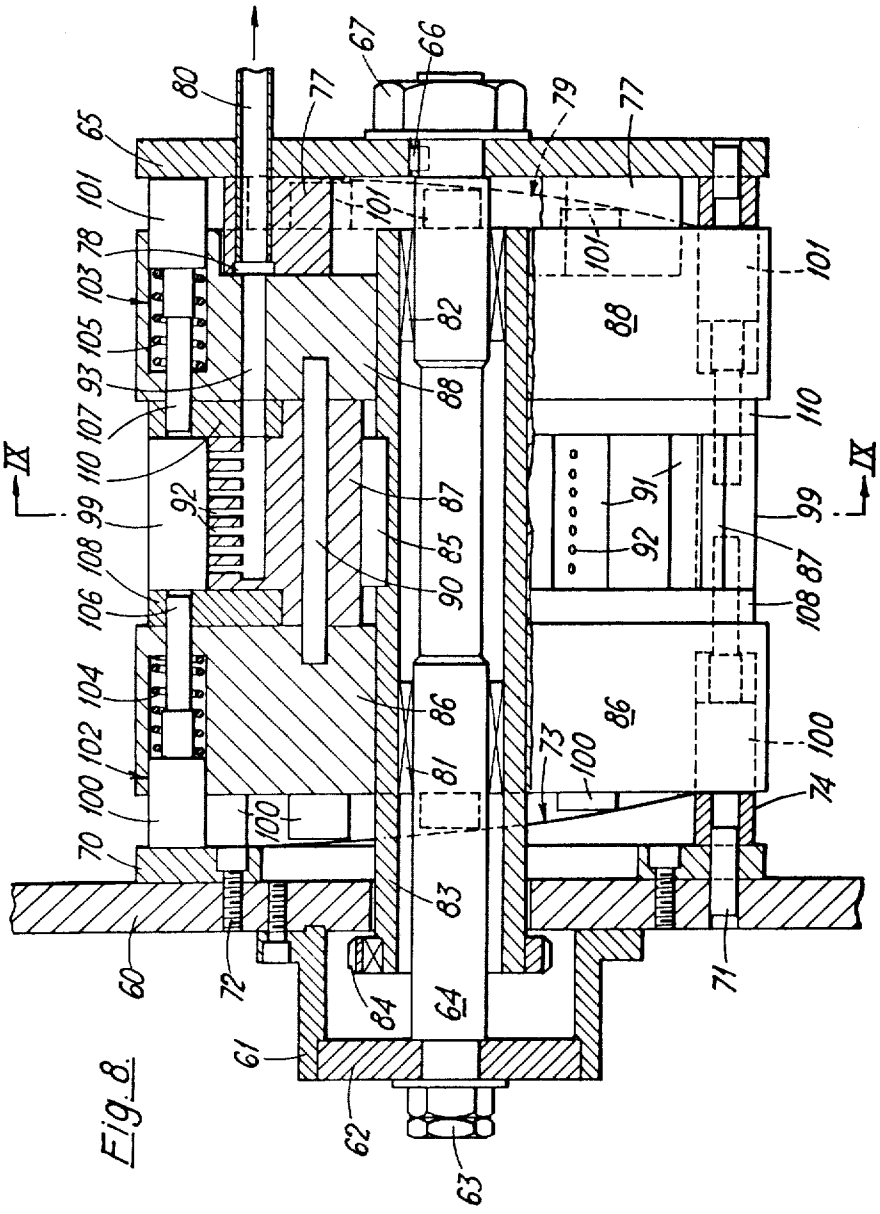

IX
IX
80
77
67
66
79
77
65
101
78
103
105
93
107
110
99
108
106
104
102
100
70
60
72
61
62
63
84
64
83
81
86
85
90
87
88
82
92
91
73
74
71

Fig. 8.

Fig. 9.

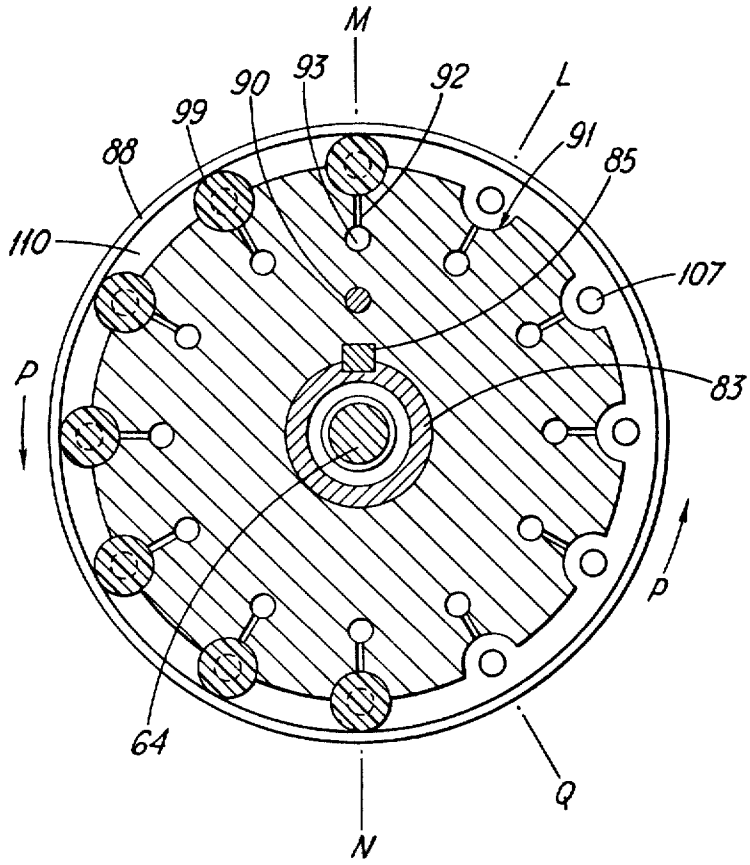


Fig. 10a.

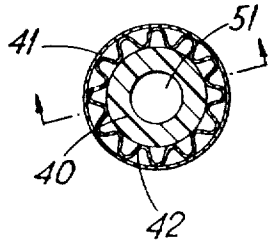


Fig. 10b.

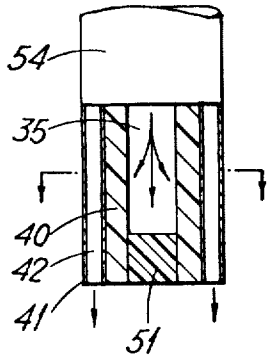


Fig. 11a.

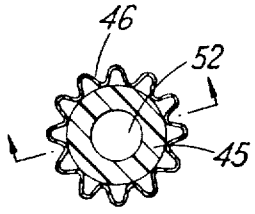


Fig. 11b.

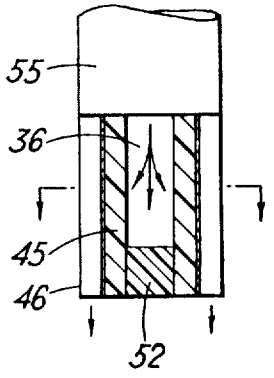


Fig. 12a.

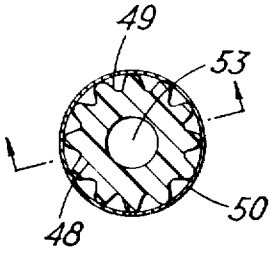
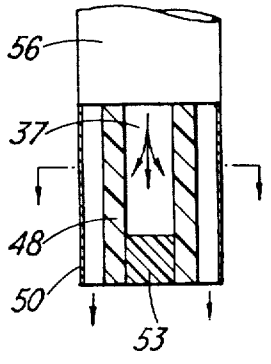


Fig. 12b.



TOBACCO SMOKE FILTER

This is a division of application Ser. No. 217,797, filed Jan. 14, 1972, now U.S. Pat. No. 3,791,265.

This invention concerns a filter for tobacco smoke, cigarettes made therewith and a process and apparatus for making such filters. The term 'cigarette' where used throughout this specification is intended to include within its scope not only conventional cigarettes but also cigars, cigarlettes and cigarillos.

According to one aspect of the present invention there is provided a method of making a tobacco smoke filter for a cigarette comprising providing a cylinder of filter material and compacting a core section of the cylinder to provide an end wall which is denser than the cylindrical wall of the filter.

Preferably the method comprises providing a double length filter rod, compacting a core section of the rod from both ends simultaneously to provide a central plug section denser than that of the cylindrical and separating the rod transversely at the central plug section to provide two hollow cylindrical filters each with one denser end wall.

According to another aspect of the present invention, there is provided apparatus for forming a filter plug having a compacted core section comprising a fluted drum for holding filter plug blanks thereon, a compacting rod aligned with each flute and adapted to reciprocate relative to the flute, and means for reciprocating each rod relative to each flute during rotation of the drum to compact a core section of a filter plug blank held in a flute of the drum.

According to another aspect of the present invention there is provided a tobacco smoke filter for a cigarette comprising a cylinder of filter material the interior of which provides a flow path of lower resistance to flow than the wall of the cylinder, one end of the cylinder being sealed with a tranverse wall member which presents a higher resistance to flow than the wall of the cylinder, whereby, in use, flow of smoke purely axially of the filter will be inhibited, causing smoke flow through the cylinder wall.

The invention also includes a cigarette comprising a tobacco rod and a hollow cylindrical filter having at the mouth end an end wall of material denser than the cylindrical wall of the filter, and smoke channels between the external surface of the filter and wrapper, whereby in use tobacco smoke passing into the interior of the filter from the tobacco rod will pass through the cylinder wall and through the smoke channels to the mouth end of the cigarette.

The invention is illustrated merely by way of example in the accompanying drawings in which,

FIG. 1 is a longitudinal cross-section through a conventional filter plug,

FIG. 2 is a longitudinal cross-section through a filter plug according to the present invention,

FIGS. 3 and 4 illustrate one method providing a filter plug as shown in FIG. 2,

FIGS. 5 and 6 illustrate a further method of providing the filter plug of FIG. 2,

FIG. 7 illustrates an alternative way of effecting the method illustrated by FIGS. 5 and 6,

FIG. 8 is a part sectional elevation of one form of apparatus for making filter plugs according to the method described with reference to FIG. 7,

FIG. 9 is a cross-section on line IX—IX of the apparatus shown in FIG. 8,

FIGS. 10*a* and 10*b* are an end cross-section and a lateral cross-section respectively through a cigarette including a filter according to the present invention,

FIGS. 11*a* and 11*b* are an end cross-section and a lateral cross-section respectively through a further cigarette incorporating a filter according to the present invention, and

FIGS. 12*a* and 12*b* are an end cross-section and a lateral cross-section respectively through yet a further cigarette incorporating a filter according to the present invention.

Referring to the drawings, and in particular FIGS. 1 and 2, there is shown in FIG. 1 a conventional filter plug 2 of cylindrical form and made of cellulose acetate fibre. In a typical plug the dimension *a*, which is the length of the cylindrical plug adapted to be disposed longitudinally of the cigarette rod is 15 mm and dimension *b* which is the diameter of the cylindrical plug, is 8 mm. With the filter plug, tobacco smoke passes from one end face of the cylinder to the other end face thereof longitudinally of the cylindrical plug, as illustrated by arrows *p*. The pressure drop of a typical cellulose acetate filter plug of these dimensions is 2½ cm of water and the efficiency of a typical plug is 30% i.e. 30% of all particulate matter carried by the smoke passing through such a plug is retained within the filter plug.

Referring now to FIG. 2 there is shown a cellulose acetate filter plug 3 according to the present invention comprising a hollow cylindrical member 4 sealed at one end with an end plug which is denser than the wall 4 and which blanks off one end of the hollow core. For comparison purposes, this plug is of the same overall dimensions as plug 2 where *a* is 15 mm. *b* is 8 mm., and furthermore *c* is 4 mm, *d* is 2 mm. and *e* is 4 mm. Because the density of the plug 5 is greater than the density of the hollow cylindrical wall 4 the flow path adopted by the tobacco smoke passing through this filter will be transversely of the cylindrical wall 4 as indicated by arrows *q*. The smoke will not pass through the end plug 15 in passing through the filter but will take the path of least resistance.

With a filter plug of the type shown in FIG. 2, a typical pressure drop has been found to be 1.8 cm. of water with an efficiency of 35%. Thus compared with the conventional plug shown in FIG. 1*a* substantially lower pressure drop is experienced whilst an increase in efficiency is achieved.

The reason for these beneficial results is thought to be the increased transverse area of filter plug material presented to the path of the tobacco smoke. Thus the area of material presented to the tobacco smoke in the plug 2 of FIG. 1 is that of a disc of diameter *b* (16 π sq.mm.) whereas in FIG. 2 the area presented to the tobacco smoke is that of the surface of a cylinder of diameter *c* and length '*a*−*c*'. (44 π sq.mm.). The substantial increase in cross-sectional area of filter material presented to the tobacco smoke (a factor of 2.75) accounts for the beneficial results achieved by decrease in pressure drop across the filter and/or increase in efficiency.

FIGS. 3 and 4 illustrate one way of forming a filter plus according to the present invention. In FIG. 3 a cylindrical plug 10 of cellulose acetate length 15 mm. diameter 8 mm., is supported upon a solid surface 6. A

cutting tool **11** of diameter somewhat less than 4 mm. is plunged into the cylindrical rod for a distance of 11 mm. whereby a core of the cellulose acetate is cut from the cylinder and, as it is cut it is compacted or compressed by the tool **11** to form a very dense wall **13** at the lower end of the cylinder as shown in FIG. **4.** If tearing is experienced in the cutting action, the use of a warm tool can assist in providing a clean cut.

The resulting plug **12** is in the form of a hollow cylinder having a cylindrical wall **14** of cellulose acetate having the same density as that of the filter plug **10** from which it was formed, and an integral end wall or plug **13** of a density which is greater than that of the wall **14.** The core **15** of the filter plug is hollow. By forming the integral wall or end plug **13** denser than the wall **14** and since and wall **13** is sealed to the cylindrical wall **14** and inhibits leaks, smoke is forced radially through the wall **14** of the cylinder in passing through the filter.

Referring to FIGS. **5** and **6** there is illustrated a further method of providing a filter plug as shown in IFIG. **2.** In this embodiment a cylindrical cellulose acetate blank **20** being 15 mm. long and 8 mm diameter and from which the filter plug is to be formed includes an external cylindrical rod **21** of cellulose acetate packed at a density similar to that of the plug **10** of FIG. 3 (i.e. at the density required for the wall of the final cigarette filter). Within the cylindrical rod **21** is a core **22** of 4 mm diameter made from cellulose acetate of a density less than that of the wall **21** and thus more easily compressible. Such a blank may be conveniently formed by co-extruding the core **22** of less dense cellulose acetate with the surrounding cylindrical rod **21** of more dense cellulose acetate.

To form a filter plug such as that shown in FIG. **2** the blank **20** of FIG. **5** is placed upon a solid support **19.** A piston **23** as shown in FIG. **6** and of diameter somewhat less than 4 mm is plunged through the core to a depth of 11 mm to compress or compact the core **22** into a dense end plug **24** of 4 mm thickness as shown in FIG. **6.** It will be appreciated that the cylindrical wall **21** will remain unaffected by this operation and will be of the same density as the material forming the plug. However the end plug **24** is arranged to be of a density greater than that of the wall **21.** Since the core **22** is distinct from and not integral with the cylindrical wall **21** of blank **20** no cutting action is required in forming the plug shown in FIG. **6,** and a simple plunging action is all that is required. Such an arrangement is simpler than that shown in FIG. **4** since no tearing is experienced and a cleaner and a more satisfactory plug is achieved. Sealing of the end plug is achieved in this embodiment by an expansion of the plug diameter during the compression longitudinally, thus sealing the plug within the cylindrical wall **21.**

In the embodiment described with reference to FIGS. **5** and **6** the core material **22** need not be the same as that forming the wall **21.** Although in the preferred embodiment described above both materials are cellulose acetate of different packing densitities, it will be appreciated that the core material could be different from that forming the wall **21.** Of course neither need be cellulose acetate. Thus suitable materials could be a foamed synthetic resin or another synthetic fibre.

Referring to FIG. **7** there is shown yet another method of achieving a filter plug according to the present invention. The method is similar to that shown in FIGS. **5** and **6** (but can be adapted to be similar to that shown in FIGS. **3** and **4**) but in which a double length filter rod is plunged from both ends simultaneously whereby a central dense wall **30** is formed with two hollow cores **31** and **32.** After the plunging operation, the filter plug is separated be severing at **33** to form two filter plugs in accordance with the present invention. The preferred method of achieving this dual length filter is in accordance with the method described with reference to FIGS. **5** and **6** since no cutting or tearing action is necessary. The cutting action of FIGS. **3** and **4** can however be employed if required. It will be appreciated that no lower support is required for the filter plug during the plunging operation since the opposed forces of the two plungers **34** will balance.

One form of apparatus suitable for producing a dual length filter plug similar to that shown in FIG. **7** is shown in FIG. **8.** This apparatus comprises a mounting plate **60** attached to the frame of a machine and having mounted thereon a cylindrical housing **61** with fixed end plate **62** into the centre of which is rigidly fixed by nuts **63** one end of a stationary shaft **64.** To the other end of the stationary shaft **64** is secured a stationary cam plate **65,** a key **66** and nut **67** being employed to secure the cam plate **65** to the shaft **64.**

Fixed to the inner face of mounting plate **60** is an annular cam plate **70.** A dowel pin **71** locates the cam plate **70** relative to the mounting plate **60** and a number of studs **72** secures the cam plate **70** to the mounting plate **60.** A cam surface **73** on the inner face of plate **70** extends adjacent the periphery of cam plate **70** starting at the top dead centre of the cam plate (i.e. at location M on FIG. **9**) with zero rise and continuing to the bottom dead centre position (i.e. at location N in FIG. **9**).

The maximum rise, at position N, is indicated by boss **74** in FIG. **8.** At this point the cam is stepped, the remainder of the cam plate from N to M (travelling anticlockwise) being planar with no cam surface.

Cam plate **65** is similarly provided on its inner face with a cam surface **79** identical in form to cam surface **73.** Cam surface **79** rises to a maximum from position M to N and is there stepped to zero for the remainder of the plate.

Also mounted on the inner face of the stationary cam plate **65** is a stationary annular carbon pad **77** provided on its inner face with an annular groove **78.** A pipe **80** connected to a source of vacuum or suction (not shown) communicates with the annular groove **78** at position M.

Mounted upon the stationary shaft **64** by needle bearings **81** and **82** is a drive shaft **83** provided at one end with a drive gear **84** connected to a drive source (not shown). Keyed by key **85** to the drive shaft **83** is a composite solid drum formed primarily of three disc segments **86, 87** and **88** fixed rigidly together (by means not shown) and doweled by dowel pin **90** to ensure accurate relative location. The central disc **87** is provided at its periphery with twelve equi-spaced semi cylindrical flutes or slots **91** (see FIG. **9**) each of the correct length and diameter to accommodate a dual length filter plug blank **99** e.g. 30 mm long and 8 mm diameter. Communicating with each slot **91** is a plurality of channels **92** which in turn communicate with a common air duct **93** which extends through disc **88** and seals against groove **78** in the annular carbon pad **77.** The annular groove **78** in the annular carbon pad **77**

extends from immediately before top dead centre position i.e. from position N as shown in FIG. **9** until the bottom dead centre position i.e. position N, extending in an anti-clockwise direction as indicated by arrow P. For the remainder of the circumference i.e. from N to L channel **78** is blanked off. Thus vacuum will be applied through the channels **92** to the semi cylindrical flutes or grooves **91** from location L until location N in order to secure and hold dual length filter plug blanks within the grooves during rotation of the drum. A hopper (not shown) disposed with its outlet between locations L and M as viewed in FIG. **9** is arranged to deposit dual length filter plug blanks into the grooves **91** as they pass the location between L and M as disc **87** rotates.

Disposed in each of the discs **86** and **88** are 12 equispaced plungers **100, 101** respectively. The plungers are housed within holes **102** and **103** respectively and in discs **86** and **88.** The ends of the plungers project to the cam plates **70** and **65** respectively and bear against the cam surfaces **73** and **79.** The plungers **100** and **101** are urged into contact with cam plates **70** and **65** by springs **104** and **105** respectively. Cylindrical tools **106** and **107** slide within locating holes provided in annular guide plates **108** and **110** between the full line positions and the broken line positions shown in FIG. **8** as the cylinder moves from the top dead centre position N illustrated in FIG. **9** to the bottom dead position N illustrated in FIG. **9.** For a 30 mm. plug blank the tools are arranged to penetrate the ends of the blank for a distance of say 11 mm, leaving an 8 mm dense wall centrally of the plug. When the 30 mm plug is severed into two 15 mm plugs the central core will form a 4 mm dense end wall for each plug in the manner described with reference to FIG. **7.**

In use, dual length filter plug blanks are fed into slots **91** between locations L and M as seen in FIG. **9,** suction being applied to the slots **91** between the position L and N whereby the filter plug blanks are held in the grooves. As the cylinder rotates from location M to N (in an anti-clockwise direction as viewed in FIG. **9**) the plungers **100** and **101** will be cammed inwardly of the filter plug blank whereby the tools **196** and **107** will compact the core of the blank from either end to form a central dense end wall. At the location N the cam surfaces are stopped whereby the plungers spring back to their retracted (full line) positions withdrawing the tools from the filter plugs. Also at location N, the suction to grooves **91** is cut off. Immediately after location N the compacted plugs are free of the grooves **91.**

Although as described, the cam surfaces and vacuum source are applied to the drum for more than half its revolution, it will be appreciated that either or both these actions could be operable for a shorter or longer period, depending upon the desired operation of the equipment.

The drum described above with reference to FIGS. **8** and **9** preferably forms part of a filter tip cigarette making machine and may for example replace the filter drum on a Hauni KFZ filter cigarette making machine. In such a machine the compacted dual length filter rods leaving the drum between locations N and Q as seen in FIG. **9** will be transferred to a drum containing two cigarette lengths located on either side of each dual length filter plug; these will be rolled in a paper wrapper to form two filter cigarettes joined end to end and will subsequently be severed to form two single filter tip cigarettes.

The filter plugs made in accordance with the present invention can be used in a variety of ways. It will be appreciated that the plug having one end blocked by a wall will present one flat surface which can be placed at the mouth end of the cigarette to provide a pleasing appearance. In this event the open end of the cylindrical plug will abut the tobacco rod of the cigarette. Alternatively, the open end of the filter rod can be at the mouth end of the cigarette the plug of the filter rod then being in abutment with the tobacco rod of the cigarette.

To achieve maximum efficiency from filters according to the present invention it is desirable that tobacco smoke passing through the walls of the filter should be permitted to pass radially through the walls rather than be forced to pass longitudinally through the walls. Should the filter plugs be wrapped by impermeable paper or relatively impermeable paper, as in conventional cigarette, the pressure drop of the filters may well be far in excess of that which is normally acceptable to the smoker since smoke will be forced to travel longitudinally through the wall of the filter.

To enable smoke to pass through the cylindrical wall radially of the plug, air ducts or passages must be provided externally of the filter plug through which the smoke can pass. Three ways in which this can be achieved are shown in FIGS. **10, 11** and **12.**

Referring to FIG. **10** there is shown the mouth end of a cigarette including a filter plug **35** in accordance with the present invention. Plug **35** has a cylindrical wall **40** and a denser end wall **51.** The plug is wrapped by a dual layer paper wrapper comprising an external cylindrical sheath **41** and an internal corrugated sheath **42.** The internal corrugated sheath **42** contacts both the external sheath **41** and the external surface of the cylindrical wall **40.** Thus air channels are provided between the corrugations of the sheath **42** and the external surface of the cylindrical wall **40.** Smoke which passes through the core of the filter **35** passed radially outwardly through wall **40** and to the smokers mouth along these longitudinal ducts or air channels.

Referring to FIG. **11** there is shown an alternative embodiment including a filter plug **36** according to the present invention comprising a cylindrical wall **45** and a denser end wall **52.** The plug is wrapped by a single corrugated or longitudinally fluted cigarette wrapper **46.** Again, air passages are provided between the flutes of the wrapper **46** and the external surface of the cylindrical wall **45** providing passageways for the smoke passing through the wall of the filter to pass to the smokers mouth. Such an arrangement of fluted or corrugated external wrapper for a cigarette also provides less surface contact between the cigarette wrapper and the smokers lips preventing sticking and also provides passage in the external corrugations of the paper in which ambient air can be drawn into the smokers mouth.

Referring now to FIG. **12** there is shown yet another arrangement including a filter plug **37** in accordance with the present invention comprising a cylindrical wall **48** and a denser end wall **53.** The plug is provided with an external longitudinally fluted surface **49** and this is wrapped by a cylindrical wrapper **50.** Again, longitudinal air channels are provided between the external

flutes of the surface **49** of wall **48** and the wrapper **50** allowing smoke to pass to the smokers mouth.

A method of making the fluted filter plug blanks from which elements **48** can be formed is described and claimed in cognate U.K. Patent applications No. 8462/70 and 23854/70.

It will be appreciated that, in the embodiments of FIGS. **10–12**, the filter plug could in each instance be reversed to place the end walls or plugs **51, 52** and **53** respectively in abutment with the tobacco rods **54, 55** and **56** respectively in which case an open cylindrical end would be presented to the smokers mouth. The open end could be blocked by an end plug but, unlike the relatively dense plug **51, 52** or **53**, this plug would be provided morely to close the end of the cylinder and would be of a material providing a less dense surface than that of the wall of the cylinder of the filter plug thus inducing the smoke to flow through this plug into the smokers mouth.

It will also be appreciated that the filter plugs according to the present invention need not be hollow but could be packed with a filter material which is less dense than that of the cylindrical wall. Nevertheless the cylindrical plug must still be provided with an end wall which is denser than that of the wall of the plug thus inhibiting flow and forcing the tobaccco smoke to pass radially through the wall of the cylinder.

The material from which filter plugs according to the present invention are made is not important although cellulose acetate and foamed and other fibrous synthetic resins are preferred.

In view of the difficulty of wrapping filter plugs with paper having convolutions or corrugations or flutes therein as shown for example in the embodiments of FIGS. **10** and **11**, the preferred embodiment according to the present invention is that shown in FIG. **12** in which the longitudinal flutes or corrugations are already extruded within the cellulose acetate rod forming the filter plug and this is merely wrapped in a conventional cylindrical sheath. Alternative arrangements can of course be provided. Thus the external surface of the filter could be dimpled or otherwise roughened merely to provide proturberences which space the overlying wrapper from the surface of the filter plug thereby providing air passages to enable the smoke to pass to the smokers mouth.

Test results with filter plugs according to the present invention indicate that more efficient plugs are provided even with pressure drops the same as these of conventional plugs. Cellulose acetate plugs of the type described with reference to FIG. 7 but of 40 mm. overall lengths were compacted to a core depth of 15 mm. either and, leaving a central wall of 10 mm. These plugs were cut into two hollow cylindrical sections, each 20 mm. long with 5 mm. dense end wall and were tested for pressure drop and efficiency. The results of three different typical samples, having different core densities before plunging, are quoted in Table **1.**

Table 1

Results. Sample.	a	b	c	d
1	0.226	1.3	37.5	9.0
2	0.276	1.6	42.1	12.0
3	0.348	1.2	41.8	8.0

In each sample the outer cylinder density was the same as that of a conventional plug of cellulose acetate. The results tabulated are:

a. Density of inner core before compacting (gm. per. cc.)

b. Pressure drop of plug after compacting (cm. of water).

c. Efficiency of compacted plugs (%).

d. Efficiency of conventional plug of same pressure drop (%)

Similar tests on conventional plain cellulose acetate plugs of the same pressure drops are also quoted, from which it will be seen that a considerable increase in efficiency is obtained with the compacted rods.

Thus with filter plugs in accordance with the present invention it is envisaged that much more efficient plugs can be provided but having the same pressure drop as those conventionally provided with present day filter plugs. By increasing the pressure drop of the filter, yet further increases in efficiency can be achieved. Rather than make compacted plugs having the same pressure drop as conventional plugs, it is possible to make plugs of the same efficiency, in which case the compacted plugs will have a lower pressure drop compared with conventional plugs.

Due to the increase in efficiency it would be possible for example to replace current dual-plug filters — e.g. of Myria (MYRIA is a Registered Trade Mark) and cellulose acetate, with single plug filters made of one material, thus providing considerable saving in cost and handling.

Substantial decreases in the pressure drop of the plug as a whole and/or substantial increases in efficiency can be achieved with filters according to the present invention compared with conventional filters of the same material and external dimensions.

What we claim is:

1. A method of making a selectively compacted tobacco smoke filter comprising providing a cylinder of filter material and compacting only a core section of the cylinder, leaving an annular uncompacted wall extending around the compacted core section.

2. A method as claimed in claim **1**, comprising providing a double length cylinder of filter material, compacting a core section only of the cylinder from both ends simultaneously to provide a central plug section denser than that of the cylindrical wall and separating the cylinder transversely at the central plug section to provide two hollow cylindrical filters each with an annular uncompacted wall extending around the compacted core section.

3. A method of making a selectively compacted tobacco smoke filter comprising providing a cylinder of filter material having a separate core of filter material therein and compacting said separate core of filter material, leaving an annularly uncompacted wall extending around the compacted core section.

4. A method as claimed in claim **3**, wherein the cylinder and core are of differing densities.

5. A method of making a selectively compacted tobacco smoke filter comprising providing a cylinder of filter material in the form of a homogeneous rod, compacting only a core section of the cylinder, leaving an annular uncompacted wall extending around the compacted core section and simultaneously cutting or shearing a core from said rod as the core is completed.

6. A method of making a selectively compacted tobacco smoke filter comprising providing a double length cylinder of filter material having a separate core of filter material therein, compacting said separate core section only of the cylinder from both ends simultaneously to provide a central plug section denser than that of the cylindrical wall and separating the cylinder transversely at the central plug section to provide two hollow cylindrical filters each with an annular uncompacted wall extending around the compacted core section.

7. A method as claimed in claim 6, wherein the cylinder and core are of differing densities.

8. A method of making a selectively compacted tobacco smoke filter comprising providing a double length cylinder of filter material in the form of a homogeneous rod, compacting a core section only of the homogeneous rod from both ends simultaneously to provide a central plug section denser than that of the cylindrical wall, separating the cylinder transversely at the central plug section to provide two hollow cylindrical filters each with an annular uncompacted wall extending around the compacted core section and simultaneously cutting or shearing a core from said rod as the core is compacted.

* * * * *