

FILTRONA NOVEL FILTERS

On 3rd March, 1983, Filtrona (UK) Ltd. presented details of a number of their novel filters to representatives from the BAT Group. Small samples were accepted for visual examination. In addition, further information on these filters has been obtained from various Filtrona patents. It is intended to purchase larger samples of these filters for more extensive laboratory tests.

Details of the construction of the filters, together with comments on the filtration characteristics claimed by Filtrona, are included in this document. This note replaces the brief note dated 11th March, circulated under a covering letter of 24th March, 1983, which should be destroyed.

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THE FILTRONA CPF FILTER

Patent No. UK 1308661, filed 21/Feb/1970

This filter (which used to be known as RDF) consists of a cellulose acetate plug wrapped in two layers of porous plug wrap. The inner layer has 22 small longitudinal grooves extending part way along the length with some 5mm of the filter left ungrooved. The ungrooved end of the filter is intended to be the mouth end and the whole construction is wrapped in an outer porous plug wrap (Figure 1).

The principle of operation for this filter is that smoke will preferentially travel along the grooves until it reaches the non-grooved section towards the mouth end. At this point, the smoke must flow across and through the porous plugwrap, giving a flow across or at an angle to the filaments rather than parallel to them. This cross-flow effect will occur whether ventilation is present or absent. It is claimed that this produces a worthwhile increase in the effectiveness of the filter compared to the performance of a conventional cellulose acetate filter. It is also claimed that filters of this type are more resilient to hot collapse. Since ventilating air and smoke mix in the body of the filter, this filter does not impinge on Actron technology.

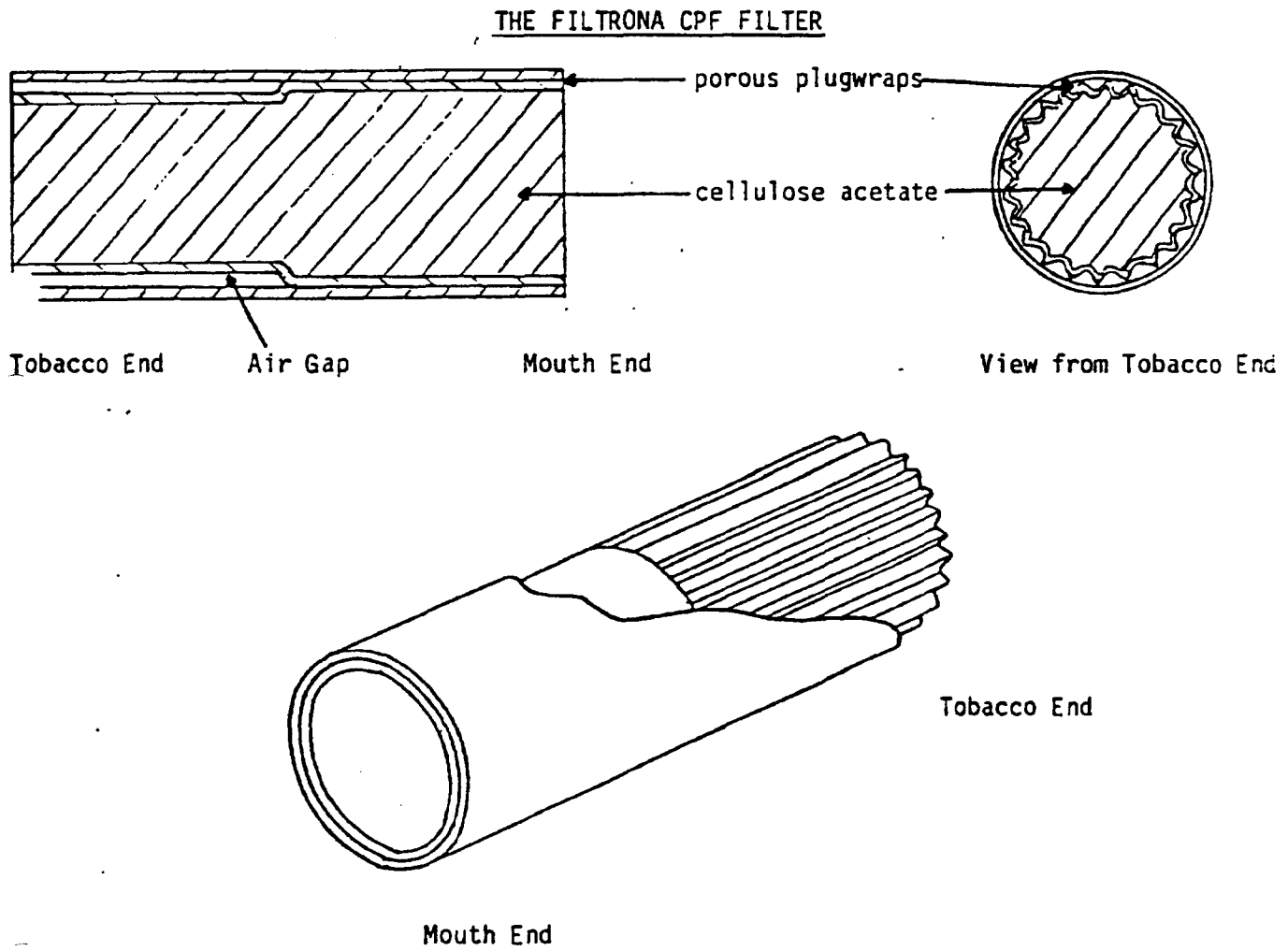
In our opinion, the principle is sound, but the magnitude of the increased filtration efficiency is fairly small (6% increase for an 85mm PD filter). A comparable performance could be obtained by simply increasing the pressure drop of the cellulose acetate filter. In modern ventilated cigarettes, filters with a high pressure drop can be used as the overall cigarette pressure drop can be kept to the required level by ventilation.

It is only possible to speculate on the method of manufacture as nothing was disclosed by Filtrona. One method would be to use pre-grooved plug-wrap, but this could present registration problems as it is necessary to cut the filter rods through the mid point of the grooved or non-grooved part of the filter. Since the two layers of plugwrap appear to be glued along the same line, it is likely that the pre-grooved paper and outer plug wrap are put on at the same time and are used as a single paper.

This filter has been available for some time. Filtrona say that this filter has not been used on any cigarette brand. Such filters are likely to be more expensive than conventional filters.

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FIGURE 1



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THE FILTRONA LRV FILTER

This filter is designed to provide a low CO/Tar ratio by the use of ventilation whilst maintaining a relatively high pressure drop.

The filter consists of a central non-wrapped acetate core with a very high pressure drop (100 mm WG/mm filter). The outer core is made of a low pressure drop, low efficiency cellulose acetate, wrapped in a porous plugwrap, to provide a preferred smoke path (Figure 2). The principle is to provide a high pressure drop, low efficiency filter so that smoke flows down the outer annulus of low efficiency CA and mixes with the ventilating air. The filter can be made available as part of a dual filter, e.g. LRV combined with a conventional cellulose acetate filter used with the LRV section at either the mouth or tobacco end. Filtrona provided very little data on the performance of these filters, but one example showed that the filtration efficiency of an LRV for nicotine was 36% compared with 56% for a conventional cellulose acetate filter of similar pressure drop. The LRV filter can be supplied with different cross-sections of the central core (e.g. triangular, square) or different colours.

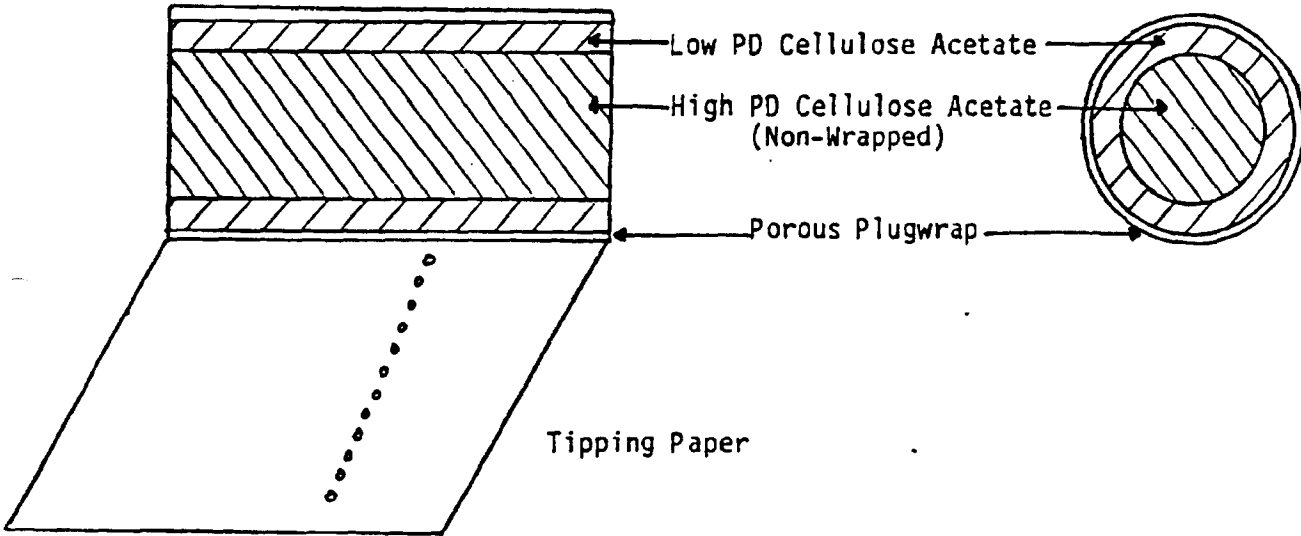
The basic concept of high pressure drop/low efficiency is not new to BAT. It is doubtful whether this filter would meet the requirements set for the current work in GR&DC where a pressure drop of 100 mm with a filtration efficiency of less than 20% was required. However, the Filtrona LRV filter could be useful for less stringent requirements, e.g. LOCO cigarettes. Although a small number of samples was obtained at the meeting, a larger number of samples, with various PD central cores, has been ordered for a more detailed evaluation.

As far as is known at present, the filter has not appeared on any commercial cigarette brand.

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FIGURE 2

THE FILTRONA LRV FILTER



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THE FILTRONA TCT FILTER

This filter is designed to provide a low CO/Tar ratio whilst maintaining a reasonable level of pressure drop as perceived by the smoker. Deliveries are controlled by varying the degree of ventilation and the retention capability of the central core.

The filter consists of a central core (circumference = 16 mm) of low pressure drop, low retention cellulose acetate wrapped in an impervious cellulose film wrap. The outer core is also made of low retention non-wrapped cellulose acetate (Figure 3). This filter achieves a low retention because air and smoke are separated by the film wrap on the core. Air enters through the ventilation holes in the tipping paper into the outer annulus and can flow both towards the tobacco and towards the mouth. Smoke flows mainly down the low pressure drop, low retention central core.

Filtrona stated that, when measured conventionally, the filter has a low pressure drop, but when measured under conditions simulating human smoking, where the mouth end of the annulus or grooves is sealed or partly sealed, a higher PD was obtained. When this occurs, the ventilating air has to flow towards the tobacco or emerge from a small cross-section of the annulus at the mouth end, via a higher PD path. The PD of the TCT filter is, therefore, perceived to be higher by the human smoker than that measured by conventional means. Although a higher perceived PD is obtained, it is claimed by Filtrona that ventilation levels and yields are not affected to any great degree.

Two forms of the TCT filter were presented, one of which had a conventional non-wrapped outer core while the other had four longitudinal grooves in the non-wrapped outer core. The TCT filters are available with different retention central cores ranging from 25% to 50%.

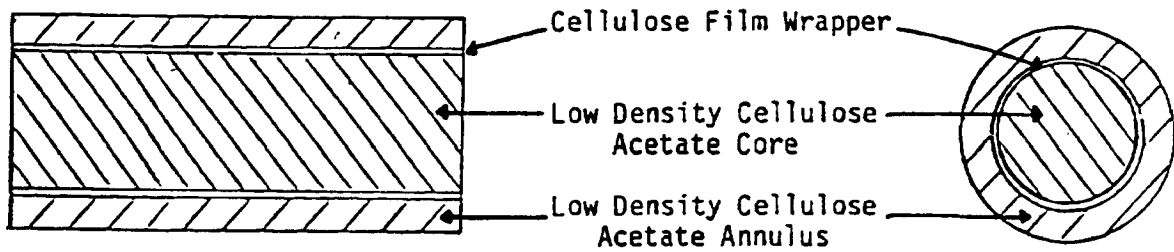
This filter is probably outside the ACTRON filter technology because the grooves extend throughout the length of the filter and the diluting air and the smoke passing through the grooves will mix.

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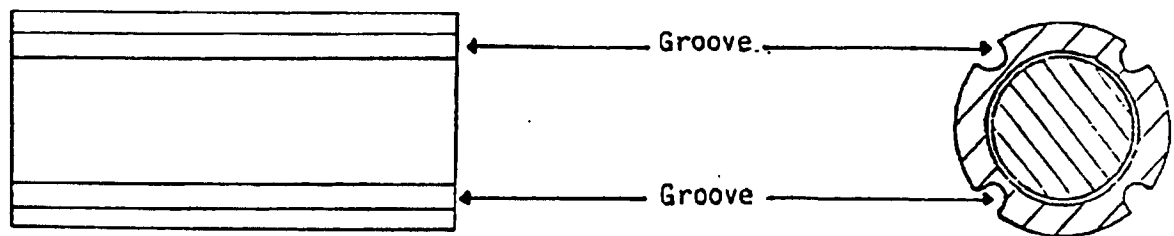
FIGURE 3

THE FILTRONA TCT FILTER

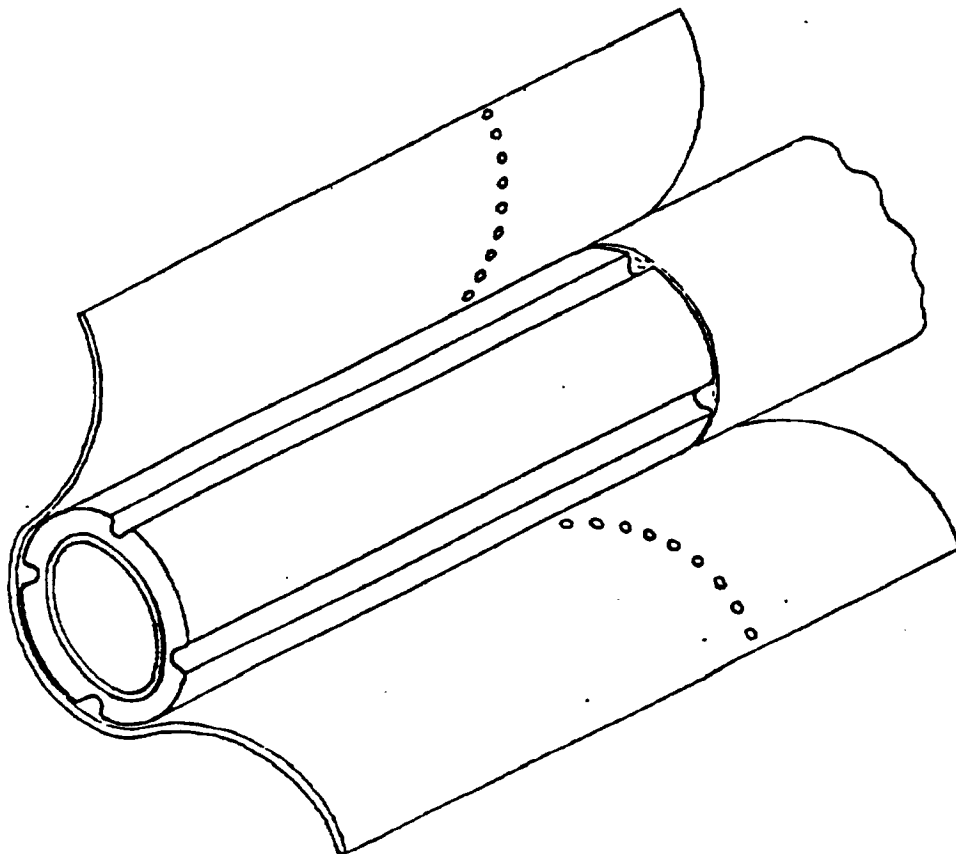
Ungrooved



Grooved



Grooved



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THE FILTRONA ASTRA FILTER

Filtrona believe that mixing smoke and air in the mouth is beneficial to the smoker and, in order to achieve this, they have developed the ASTRA filter.

There are three variants of the ASTRA filter, two of which were presented at the meeting (Figure 4). The simplest version consists of a cellulose acetate core wrapped in a heavy longitudinally corrugated, air impermeable plugwrap. There are 22 or 23 longitudinal grooves around the periphery of the filter. Although not mentioned by Filtrona at the meeting, the plugwrap could be a paper/polyethylene/paper laminate as mentioned in UK Patent Application No. GB 2104372A.

It was stated by Filtrona that, when this filter is used on a ventilated cigarette, the diluting air will flow down through the grooves and not enter the cellulose acetate core due to the impermeable plugwrap. However, some smoke is likely to flow down through the grooves, but most will flow through the filter core. The proportion of smoke passing through the grooves and filter core will depend upon the pressure drop through the core and grooves. Hence, the filter probably provides a means of substantially, but not completely, separating the diluting air and smoke. The filter differs from the ACTRON filter in that the grooves traverse the whole length of the filter.

The second version of the ASTRA filter consists of the filter mentioned above but circumferential grooves have been inserted in the plugwrap at the tobacco end of the filter. This filter is described in UK Patent Application No. 2102271A. The effect of this is to provide a resistance to the passage of smoke through the grooves. In the patent application, it is stated that "there can be little or no previous mixing of air and smoke". In this respect, the concept is quite close to that of the ACTRON filter. However, in practice, where the two sets of grooves intersect there are still small passages through which some smoke will be able to pass and, in this respect, the ASTRA filter differs slightly from the ACTRON filter.

The third version of the ASTRA filter consists of a dual core within the corrugated wrapper in which the cross-grooves can be present or absent. The dual core can be in the form of a paper/acetate or acetate/acetate and presumably it could be possible to use acetate containing activated carbon as one of the sections in combination with an acetate filter second section.

The acetate/acetate dual version (without cross-grooves) of this filter has been used on the St. Moritz cigarette launched recently by Rothmans in Holland. So far, we have not been able to understand the advantages of this particular dual construction over the use of the single acetate core version. It is intended to purchase samples of these three versions for evaluation.

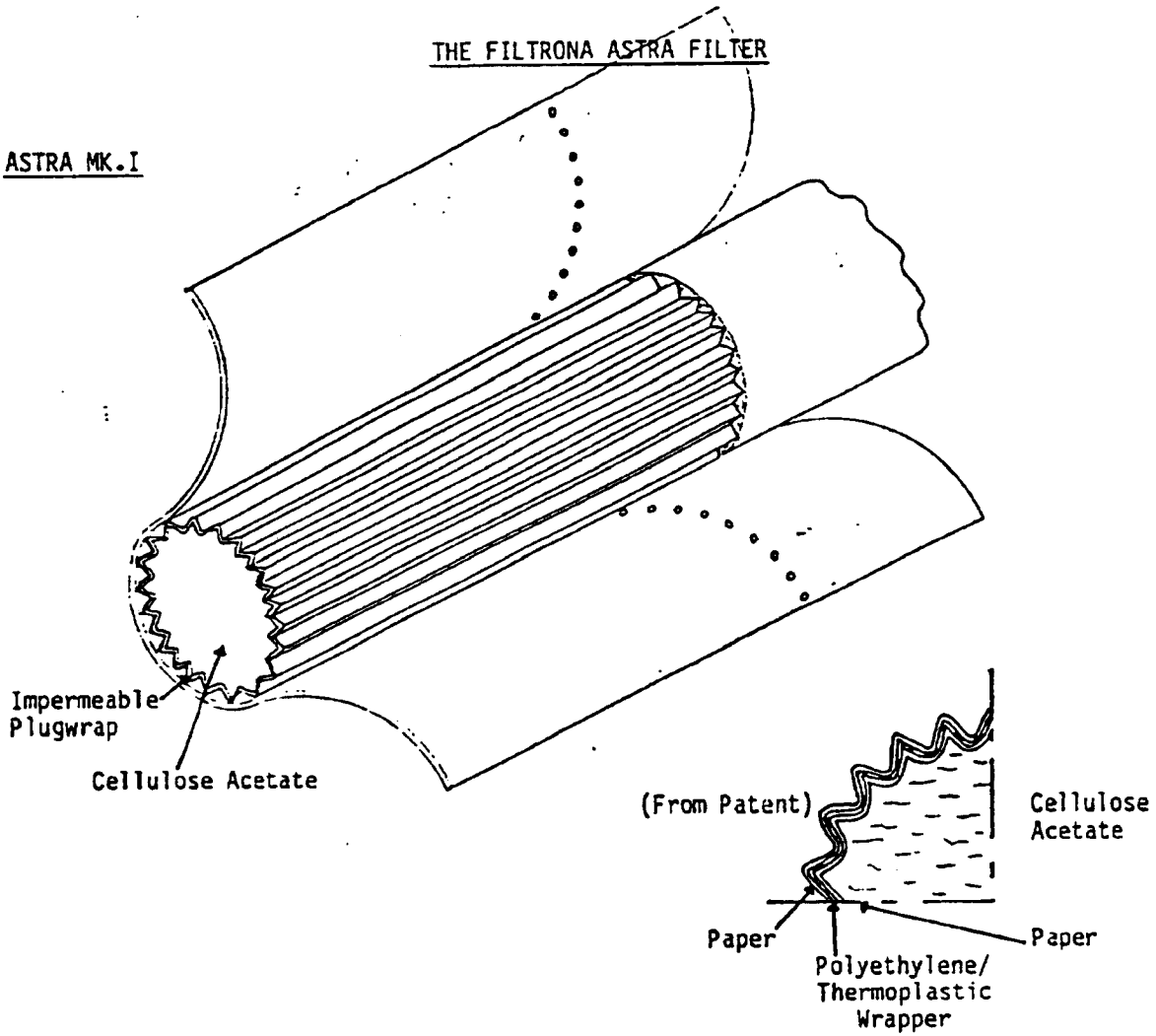
According to the patent (2102271A), there are other variants of the cross-grooved ASTRA filter. The cross-grooving can be moved towards the mouth end, but no such samples were exhibited by Filtrona.

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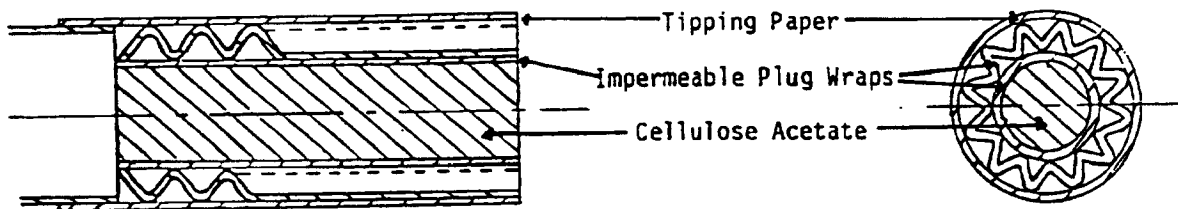
FIGURE 4

THE FILTRONA ASTRA FILTER

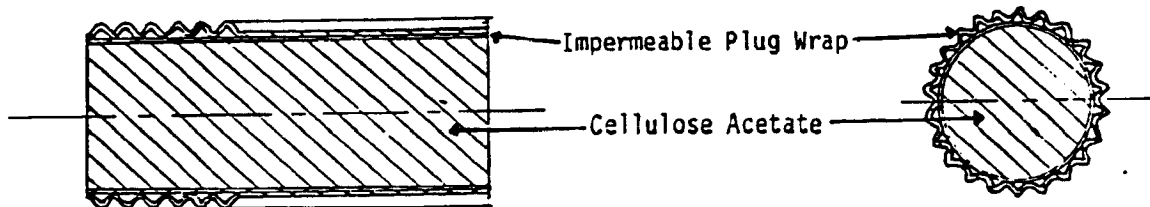
ASTRA MK.I



ASTRA MK.II (From Patent)



ASTRA MK.II (As Received)



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THE FILTRONA SCS FILTER

This filter is well known and has been used commercially for many years. It consists of a thick walled tube of cellulose acetate filaments closed at one end with the other end open. It can be attached to the cigarette with the open end towards the mouth or tobacco.

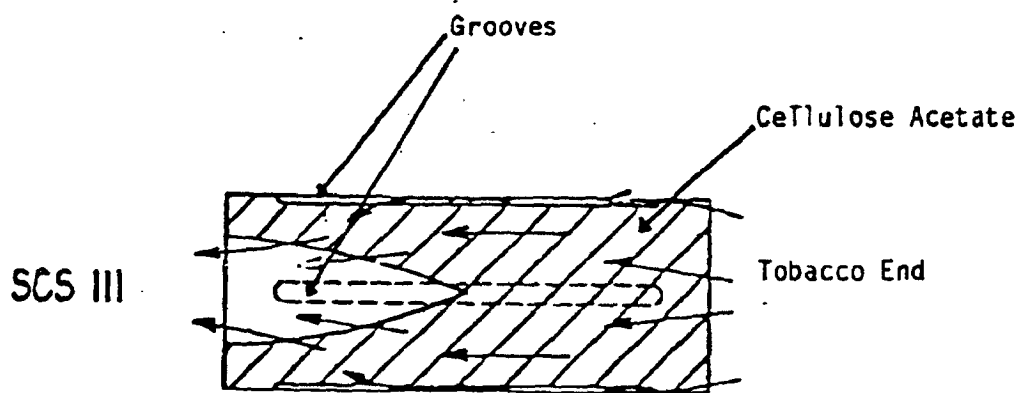
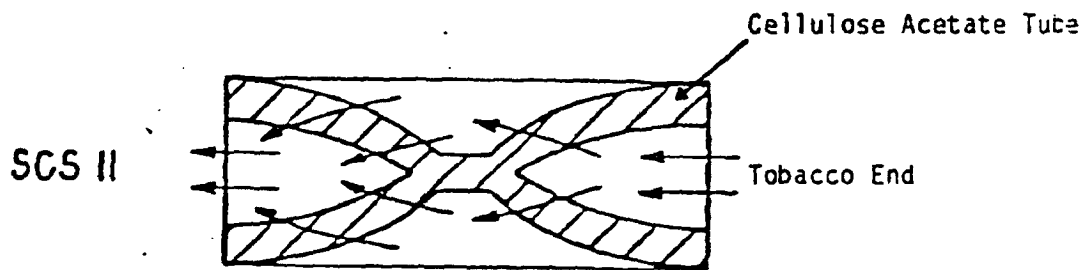
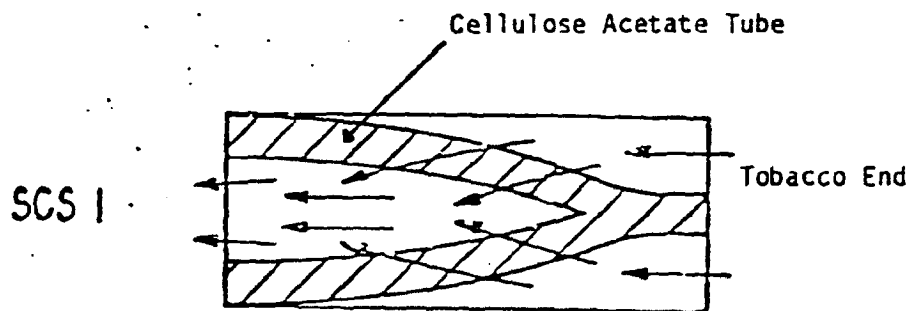
The concept of this filter is that smoke is caused to flow across the filaments instead of along the length as in a conventional filter. Filtration efficiencies are higher in the SCS filter than in a conventional cellulose acetate filter of similar pressure drop due to the cross-flow effect. The main disadvantage of this filter is the high cost due to the relatively high weight of cellulose acetate, the high packing density of the tube and slow production speeds. Advantages of the filter are the high tar retention and novelty since the inner wall of the tube can be made in various shapes - circular, triangular, X-shaped, Y-shaped, corrugated, etc.

There are three variants of this filter (Figure 5). The SCS III has peripheral grooves for use with ventilation. The SCS I has been used by R.J. Reynolds on the Vantage cigarette for many years. The SCS III is used on the Ducados brand in Spain.

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FIGURE 5

THE FILTRONA SCS FILTER



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THE FILTRONA P8F FILTER

Patent No. GB.2098051A

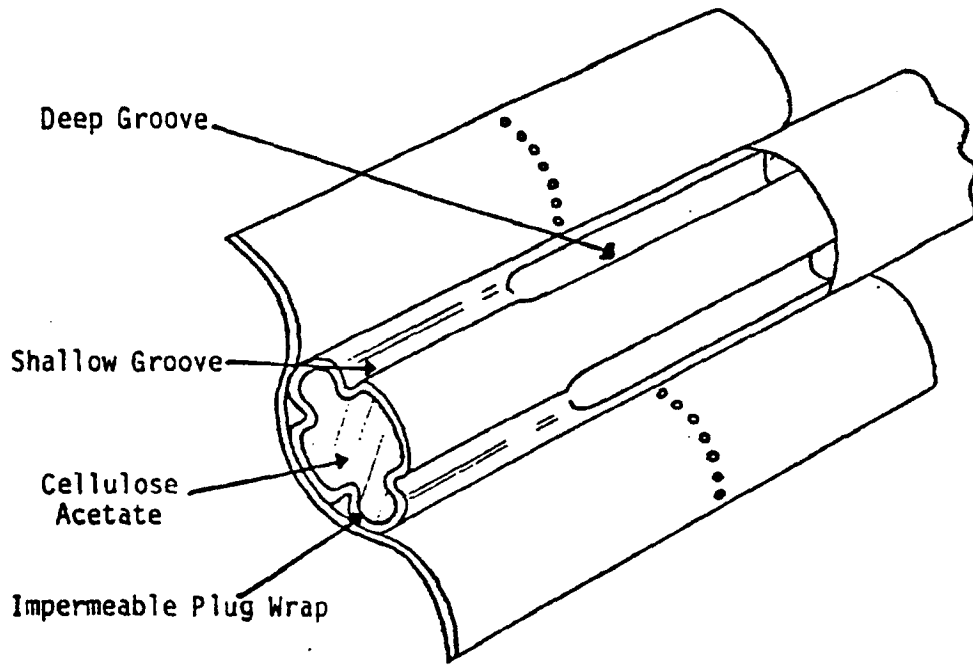
This filter consists of a cellulose acetate filter wrapped in an air impervious plug wrap. Along the length of the filter are longitudinal grooves which are formed in the impervious plug wrap. There are two depths and widths of grooves formed as shown in the diagram. Ventilating air is allowed to enter the grooves via the ventilated tipping paper and may flow towards the tobacco or mouth end of the filter depending upon the groove orientation (Figure 6).

Although Filtrona claim that this filter will give a low CO/tar ratio and is designed to be used with ventilation, its concept is very similar to the ACTRON filter. This filter has not been used for commercial brands and Filtrona added that no further developments were envisaged unless some interest is shown by a customer. Any further information concerning this filter must be obtained from Filtrona, USA. Although a list of questions was submitted to Filtrona prior to the meeting, Filtrona UK said it had not been possible to obtain answers from Filtrona USA. We felt they did not want to discuss this further.

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FIGURE 6

THE FILTRONA PBF FILTER



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GENERAL COMMENTS

From the various comments made by Filtrona during the discussion, it was evident that their development policy was to produce novel filters based on the following concepts:

- (a) high filtration/low pressure drop;
- (b) low filtration/high pressure drop;
- (c) means of reducing carbon monoxide via ventilation;
- (d) means of separating diluting air and smoke.

This is very similar to some of the GR&DC thinking, but this was not disclosed to Filtrona. Their approach appeared to be short term, aimed at development of marketable products as quickly as possible whilst making maximum use of their existing technology. All the filters presented must have required very close co-operation between laboratory and production facilities. Recently, Filtrona have moved their research facilities to their factory site at Jarrow. There was no evidence of long term filter research such as modelling, understanding smoke filtration or any work on selective filtration. In this respect, their approach differs from GR&DC.

Finally, it was apparent from our discussions that Filtrona USA work somewhat independently from Filtrona UK, since there were difficulties in obtaining information from Filtrona USA on the PBF filter, which was developed in the USA. A similar situation occurred some time ago when Filtrona UK offered small samples of another USA development (the CO filter) which we understood was not being pursued unless required by interested customers.

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