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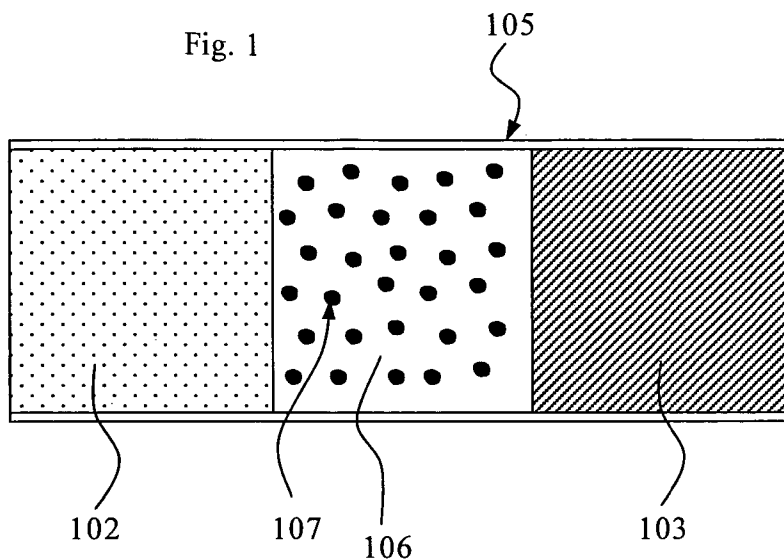
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(54) Title: TOBACCO SMOKE FILTER

Fig. 1



(57) Abstract: A tobacco smoke filter or filter element including an adsorbent material wherein the adsorbent material is coated by a polymer material in an amount from between 0.4% to 5% w/w based on the weight of the adsorbent material.

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TOBACCO SMOKE FILTER

The present invention relates to tobacco smoke filters, especially for cigarettes. In particular, it relates to tobacco smoke filters which include additives, for example particulate additives, such as activated carbon.

5 The use of additives such as activated carbon in tobacco smoke filters is well known. However, the processing of activated carbon and/or the inclusion of activated carbon in the filter can cause significant problems due to dust caused by particles, fragments etc. of the activated carbon. For example, the carbon dust may contaminate the filter-making
10 machinery and process, leading to contamination of the product filter (e.g. poor end appearance due to visibility of activated carbon dust particles). Further, the inclusion of activated carbon in the filter may result in dust particle breakthrough (the release of small particles into the smoke fluid stream) which is undesirable. It is also known that conventional use of
15 activated carbon in tobacco smoke filters is associated with a loss of vapour phase removal efficiency on storage prior to use e.g. after cigarette manufacture but before the pack is opened by the consumer.

 According to the present invention there is provided a tobacco smoke filter or filter element including an adsorbent material – e.g. a
20 particulate adsorbent material - wherein the adsorbent material is coated by a polymer material in an amount from between 0.4% to 5% w/w based on the weight of the adsorbent material.

 The adsorbent material – e.g. the particulate adsorbent material – may be any material which may remove one or more components in the
25 vapour state (e.g. one or more of acetaldehyde, 1,3-butadiene, acrolein, propanaldehyde, acetone, acrylonitrile, isoprene, butyraldehyde, methyl ethyl ketone, crotonaldehyde, benzene and toluene) from tobacco smoke by adsorption (and/or absorption and/or chemical reaction). The adsorbent material may be carbon, for example activated carbon. The

carbon e.g. activated carbon may be a coconut based activated carbon, or e.g. carbon or activated carbon prepared from other precursor materials (e.g. other nut shells, fruit stones, coal, lignite, wood, peat, organic polymers etc). The adsorbent - e.g. particulate adsorbent - material may be, for example, zeolite, ion exchange resin (e.g. weakly basic ion exchange resin), sepiolite, silica gel, alumina, molecular sieves, carbonaceous polymer resins and diatomaceous earths. The adsorbent - e.g. particulate adsorbent - may be in the form of granules. It will be appreciated that adsorbent particles/granules of any size suitable for use in tobacco smoke filters may be used with filters and filter elements of the invention. For example, adsorbent particles of 10 to 100 BS Mesh (which corresponds to particles of diameter between 1.7mm and 0.15mm) may be used.

The adsorbent material is coated with a polymer material. The polymer material may polyethylene or polyurethane. Other polymer materials (e.g. polyvinyl acetate, polyvinyl alcohol, polymethacrylic acid) may be used. The polymer material may include a pigment or colouring agent or other material which imparts colour to the polymer. The inclusion of a coloured polymer may provide a coloured adsorbent material e.g. a coloured e.g. red, blue, white, yellow, green etc. particulate adsorbent material. The inclusion of this material may be used as an anti-counterfeiting measure.

The amount of polymer material is 0.4% to 5% w/w (based on the weight of the adsorbent material), for example, 0.5% to 3%, for example 0.6% to 2.8%, for example 0.7% to 2.5%, for example 0.9 to 2.1%, for example 1 to 2%.

According to the present invention in a further aspect there is provided a tobacco smoke filter or filter element including an adsorbent material - e.g. particulate adsorbent material - coated with polyurethane. The adsorbent material may be coated with polyurethane in an amount of

from between 0.4% to 5% w/w based on the weight of the adsorbent material, for example, 0.5% to 3%, for example 0.6% to 2.8%, for example 0.7% to 2.5%, for example 0.9 to 2.1%, for example 1 to 2%.

The applicants have surprisingly found that tobacco smoke filters
5 and filter elements according to the invention may provide a marked reduction in the number of dust particles released from product filters (for example as measured by the particle breakthrough measurements) in use, with little or no significant loss of vapour phase reduction performance. The applicants have also surprisingly found that there may be a marked
10 reduction in the dust associated with the filter making process (e.g. reduction in the amount of contamination of the machinery and/or product tobacco smoke filters or filter elements).

*Further, tobacco smoke filter or filter elements which include an adsorbent material – e.g. particulate adsorbent material – which is coated
15 as described above may be less prone to loss of vapour phase removal efficiency on storage.*

The tobacco smoke filter or filter element of the invention may be in the form of any tobacco smoke filter or filter element which is known in the art for use with the inclusion of adsorbent (e.g. particulate adsorbent
20 material, e.g. activated carbon) with the (particulate) adsorbent material coated with the defined amount of polymer material substituted for the adsorbent material in the known filter. For example, the tobacco smoke filter or filter element according to the invention may be in the form of an active acetate filter or filter element, triple granular filter – for example such
25 as that shown in Fig 1, active patch filter or element, a filter or element such as that described in PCT/GB2005/004644, coated thread filters, or variations or component thereof etc.

Thus, according to the present invention in a still further aspect
30 there is provided a tobacco smoke filter or filter element comprising: a

longitudinally extending core of tobacco smoke filtering material; and an adsorbent material; wherein the adsorbent material is coated by a polymer material in an amount from between 0.4% to 5% w/w based on the weight of the adsorbent material. The longitudinally extending core is of (or includes) air permeable material. The filter or filter element may, for example, further comprise a wrapper e.g. arranged around the core. The adsorbent material (e.g. particulate adsorbent material e.g. activated carbon) coated with polymer (e.g. polyethylene, polyurethane) may be located in or on the longitudinally extending core, and/or in or on the wrapper (if present) as e.g. patches, stripes etc..

According to the present invention in a still further aspect there is provided a tobacco smoke filter or filter element comprising: a longitudinally extending core of tobacco smoke filtering material; and an adsorbent material, wherein the adsorbent material is coated with polyurethane. The longitudinally extending core is of (or includes) air permeable material. The filter or filter element may, for example, further comprise a wrapper e.g. arranged around the core. The adsorbent material (e.g. particulate adsorbent material e.g. activated carbon) coated with polyurethane may be located in or on the longitudinally extending core, and/or in or on the wrapper (if present) as e.g. patches, stripes etc..

The longitudinally extending core of tobacco smoke filtering material may include a cellulose acetate plug – e.g. cellulose acetate tow. In one example, this may be combined with particles of carbon e.g. particles, preferably granules, of activated carbon which is coated with polymer (e.g. polyethylene, polyurethane) as defined above; e.g. carried on the cellulose acetate tow or filaments or fibres or sheet material which is gathered to form the plug. In another example, the longitudinally extending core may comprise a rod-shaped matrix of tobacco smoke filtering material plug – e.g. cellulose acetate tow - having fully enclosed therewithin a pocket – e.g. an ellipsoidal pocket - of particulate additive

e.g. particles, preferably granules, of activated carbon which is coated with polymer (e.g. polyethylene, polyurethane) as defined above. Other configurations are possible and would be known to the skilled man, see e.g. discussion above.

5

In a filter cigarette according to the invention a filter according to the invention (or filter which includes a filter element according to the invention) is joined to a wrapped tobacco rod with one end towards the tobacco. The filter may for example be joined to the wrapped tobacco rod
10 by tipping (which engages around just the adjacent ends of filter and rod to leave much of the filter wrapper exposed) or by a full tipping overwrap (which engages around the full filter length and adjacent end of the rod). Any filter or filter cigarette according to the invention may be ventilated by methods well known in the art, e.g. by use of a pre-perforated or air-
15 permeable plug wrap, and/or laser perforation of plugwrap and tipping overwrap.

According to the present invention in a still further aspect there is provided a method of attaching a wrapped tobacco rod to a filter or filter element as described above or herein.

20 According to the present invention in a still further aspect there is provided the use of a polymer coated adsorbent in the manufacture of an adsorbent (e.g. particulate adsorbent) containing tobacco smoke filter or filter element, or the manufacture of a smoking article including such
adsorbent (e.g. particulate adsorbent) containing filters or filter elements,
25 e.g. for reducing dust or other particulate contamination of e.g. the product during manufacture. According to the present invention in a still further aspect there is provided a method of reducing dust or other particulate contamination in the manufacture of an adsorbent (e.g. particulate
adsorbent) containing tobacco smoke filters or filter elements, or the
30 manufacture of smoking articles including such adsorbent (e.g. particulate

adsorbent) filters or filter elements, comprising a step of applying a polymer coating to the adsorbent. The adsorbent, polymer coating, and amounts may be as described and defined above.

The present invention will now be illustrated by way of example,
5 with reference to the accompanying drawings, in which:-

FIGURE 1 shows a schematic side elevation view, not to scale, of a triple granular filter of the invention.

In Fig 1, a triple granular filter has a cylindrical downstream or buccal end filtering plug 102 of filtering material in the form of a wrapped
10 cellulose acetate plug of length 6mm, a cylindrical upstream (tobacco end) filtering plug 103 in the form of a wrapped cellulose acetate plug of length 6mm, the plugs 102 and 103 being longitudinally spaced a 5mm distance from each other. A filter wrapper 105 of air-permeable paper is engaged around the plugs to form a cavity 106 of length 5mm between the
15 downstream plug 102 and the upstream plug 103. The cavity 106 has, located therein, adsorbent additive 107 in the form of 75 milligrams of 12/30 mesh granules of activated carbon (standard coconut-based carbon as typically used in cigarette filter applications) coated (by known methods) with around 2% w/w polyethylene, based on the weight of the
20 activated carbon.

It will be appreciated that the triple granular filter of Fig 1 is structurally similar to known triple granular filters but includes coated activated carbon which may provide improved performance. It will be appreciated that the filter of Figure 1 may be made by methods well known
25 in the art, readily adapted for use with coated carbon.

Examples

It is known that carbon containing filters are more prone than conventional monoacetate filters to release small particles into the fluid

stream when subjected to simulated puffing or continuous draw conditions. Particle breakthrough (PBT) measurements represent a means of quantifying the number of particles released by different cigarette filter types under such conditions. The present applicants have developed a method for measuring PBT from filters, which has been used to compare the performance of filters with and without coated carbons.

Example 1

Two batches of 'triple granular' filter rods (each 102 mm in length) were assembled on conventional filter-making machinery. These were "the control filters" and "the Example 1 filters".

Each batch provided tips of 17 mm length – a 5-mm cavity containing around 75 mg of 12/30 mesh carbon sandwiched between two 6-mm cellulose acetate end segments – of similar structure to that illustrated in Fig 1. The control filters incorporated a standard - i.e. non coated - coconut-based carbon as typically used in cigarette filter applications. The Example 1 filters, which were of the invention, incorporated a standard coconut-based carbon as typically used in cigarette filter applications, which had been coated with around 2% w/w polyurethane. Mean PBT was reduced from 96 particles for the control filters to 29 particles for the coated carbon Example 1 filters, indicating a marked reduction in particle breakthrough provided by the coated carbon.

25

Example 2

Polyethylene coated activated carbon was prepared by known methods. Coconut-based carbons of both 60% and 100% carbon tetrachloride (CTC) activity were coated with polyethylene at amounts of 0.5%, 1.0% and 2.0% w/w.

The comparative ability of these coated carbons to remove vapour phase (VP) constituents from tobacco smoke was assessed by assembling cigarettes with 'triple granular' filters, of similar structure to the filter of Fig 1, each containing 80mg of the polyethylene coated activated carbon carbon in a packed bed between two cellulose acetate filter segments. The filter cigarettes were smoked under ISO conditions and the relative yields of a range of 12 VP compounds (acetaldehyde, 1,3-butadiene, acrolein, propanaldehyde, acetone, acrylonitrile, isoprene, butyraldehyde, methyl ethyl ketone, crotonaldehyde, benzene and toluene) measured as compared to a control cigarette with an empty cavity. The arithmetic mean reduction in VP of these 12 compounds for the 60% CTC set of samples is given in the following table:

Polyethylene Coating (% w/w)	CTC Activity (%)	Mean VP Reduction (%)
0	66	84
0.5	64	84
1.0	64	82
2.0	64	81

Although it would be expected that the presence of a polymeric coating would tend to block active sites on the surface of the carbon and thereby significantly reduce its ability to remove the VP compounds from smoke, surprisingly this anticipated loss of performance quite clearly did not occur.

Example 3

'Triple Granular' filters of similar structure to that of Figure 1, containing either an empty cavity; 80 mg of 60 CTC or 100 CTC activated carbon, or 80mg of the coated activated carbons described in Example 2, were carefully assembled by hand. The mean PBT was measured over a total

of 10 replicate samples. The mean PBT values for each sample are given below:

Sample	Activated Carbon (in triple granular filter cavity)	Coating	PBT Value (particles)
Empty	None	None	10
60 CTC base	60 CTC	None	135
100 CTC base	100 CTC	None	173
100 CTC (0.5% PE)	100 CTC	Polyethylene 0.5% w/w	46
100 CTC (1.0% PE)	100 CTC	Polyethylene 1% w/w	16
100 CTC (2.0% PE) -	100 CTC	Polyethylene 2% w/w	7

- 5 It can be seen that polyethylene-coating levels in the range 1-2% gave a dramatic reduction in PBT for these filters, with values comparable to non-carbon bearing filters.

The examples above indicate that, surprisingly, tobacco smoke filters and filter elements according to the invention may provide a marked reduction in the number of dust particles released from filters (for example as measured by the particle breakthrough measurements) with little or no significant loss of vapour phase reduction performance.

CLAIMS

1. A tobacco smoke filter or filter element including an adsorbent material wherein the adsorbent material is coated by a polymer material in an amount from between 0.4% to 5% w/w based on the weight of the
5 adsorbent material.
2. A tobacco smoke filter or filter element according to claim 1 wherein the polymer material is polyethylene or polyurethane.
3. A tobacco smoke filter or filter element according to claim 1 or claim 2 wherein the amount of polymer is 0.9 to 2.1% w/w, based on the weight
10 of the adsorbent material.
4. A tobacco smoke filter or filter element including an adsorbent material coated with polyurethane.
5. A tobacco smoke filter or filter element according to any preceding claim wherein the adsorbent material is a particulate adsorbent material.
- 15 6. A tobacco smoke filter or filter element according to any preceding claim wherein the adsorbent material is one or more of carbon, activated carbon, zeolite, an ion exchange resin, sepiolite, silica gel, alumina, molecular sieve, carbonaceous polymer resin or diatomaceous earth.
7. A tobacco smoke filter or filter element according to any preceding
20 claim wherein the adsorbent material is in the form of granules.
8. A tobacco smoke filter or filter element according to any preceding claim wherein the adsorbent material is activated carbon which is a coconut based activated carbon, or activated carbon prepared from other precursor materials such as other nut shells, fruit stones, coal, lignite,
25 wood, peat, organic polymer.

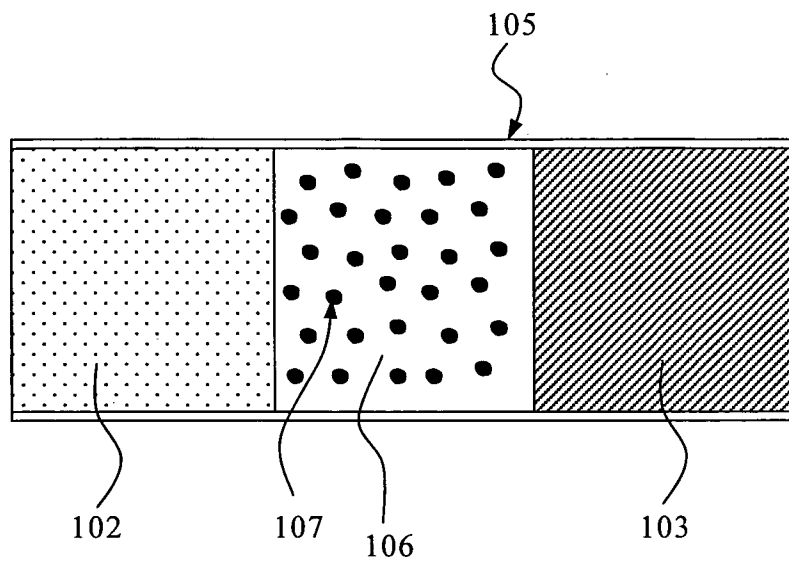
9. A tobacco smoke filter or filter element according to any of claims 1 to 3 or 5 to 8 wherein the polymer material includes a pigment or colouring agent or other material which imparts colour to the polymer.
10. A tobacco smoke filter or filter element according to any of claims 4 to 8 wherein the polyurethane includes a pigment or colouring agent or other material which imparts colour to the polyurethane.
11. A tobacco smoke filter or filter element comprising: a longitudinally extending core of tobacco smoke filtering material; and an adsorbent material; wherein the adsorbent material is coated by a polymer material in an amount from between 0.4% to 5% w/w based on the weight of the adsorbent material.
12. A tobacco smoke filter or filter element comprising: a longitudinally extending core of tobacco smoke filtering material; and an adsorbent material, wherein the adsorbent material is coated with polyurethane.
13. A tobacco smoke filter or filter element according to claim 11 or 12 further comprising a wrapper.
14. A tobacco smoke filter or filter element according to any of claims 11, 12 or 13 wherein the coated adsorbent material is located in or on the longitudinally extending core.
15. A tobacco smoke filter or filter element according to claim 13 or 14 wherein the coated adsorbent material is located on the wrapper.
16. A tobacco smoke filter or filter element substantially as hereinbefore described with reference to the attached drawing.

17. A filter cigarette including a filter according to any preceding claim, or a filter which includes a filter element according to any preceding claim, joined to a wrapped tobacco rod.

18. The use of a polymer coated adsorbent in the manufacture of an
5 adsorbent containing tobacco smoke filter or filter element, or in the manufacture of a smoking article including such adsorbent containing filters or filter elements, for reducing dust or other particulate contamination during manufacture.

19. A method of reducing dust or other particulate contamination in the
10 manufacture of an adsorbent containing tobacco smoke filters or filter elements, or the manufacture of smoking articles including such adsorbent filters or filter elements, comprising a step of applying a polymer coating to the adsorbent.

Fig. 1



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/001762

A. CLASSIFICATION OF SUBJECT MATTER
INV. A24D3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 421 707 A (ACETATE PRODUCTS LTD [GB]). 5 July 2006 (2006-07-05) page 2, line 12 - page 3, line 33	16-19
Y	page 10, line 30 - page 11, line 12; figure 2	12-14
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A		2,4
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Y	US 3 381 070 A (SUBLETT BOBBY J ET AL) 30 April 1968 (1968-04-30) figure 3	12-14
	-/--	

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

20 August 2008

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02/09/2008

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/001762

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 03/059096 A (PHILIP MORRIS PROD [CH]; PAINE JOHN B III [US]; YANG ZUYIN [US]; KOLLE) 24 July 2003 (2003-07-24) paragraphs [0015], [0017]; figures 1-3	1-19

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2008/001762

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB2008 /001762

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11

filter having an absorbent coated with 0.4-5% polymer

2. claims: 12-17

filter having adsorbent coated with PU

3. claims: 18, 19

use of a polymer coated adsorbent for reducing dust during filter manufacture

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2008/001762

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