

(19)



(11)

EP 2 745 717 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.06.2014 Bulletin 2014/26

(51) Int Cl.:
A24B 15/28 ^(2006.01) **A24D 3/06** ^(2006.01)

(21) Application number: **12197703.7**

(22) Date of filing: **18.12.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **JT International SA**
1211 Geneva 26 (CH)

(72) Inventor: **McLaughlin, Davin**
BT44 9RG Co. Antrim (IE)

(74) Representative: **Haley, Stephen**
Gill Jennings & Every LLP
The Broadgate Tower
20 Primrose Street
London EC2A 2ES (GB)

(54) **Frozen capsules and method of making same**

(57) A method of forming a breakable capsule for a smoking article is disclosed. The method comprises the steps of:

(i) providing the core of the capsule,

(ii) providing said core with a capsule envelope to form said capsule, and
(iii) freezing said capsule.

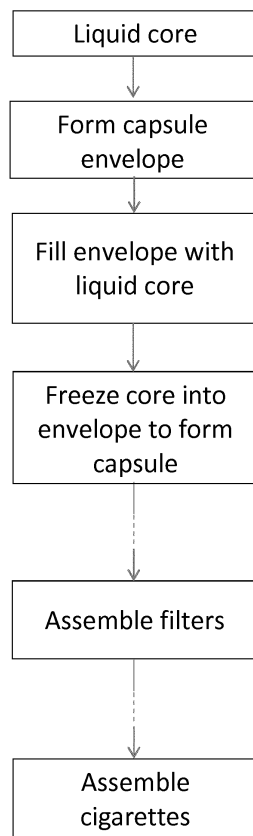


Figure 1A

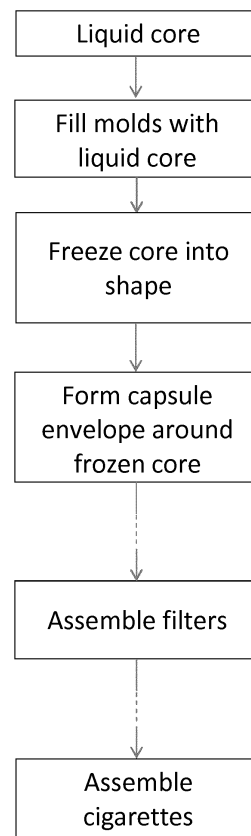


Figure 1B

EP 2 745 717 A1

Description

[0001] The present invention relates to a breakable capsule for a smoking article and a method of making such capsules. In particular, the invention relates to a breakable capsule which can be broken easily by the user, and a method of making capsules by incorporating a freezing step.

[0002] It is relatively well known to provide smoking articles with a filter which contains one or more user-activated components.

[0003] The purpose of the component(s) is to allow a user to activate it when desired to alter the smoke during the smoking process. The component is often provided in the form of a capsule which is crushed by a user to add flavour to smoke while using the smoking article.

[0004] Whilst such smoking articles are becoming popular amongst users, there can be a problem in that it is often difficult for the user to break the capsules to release the components inside. Therefore a considerable amount of force is required to break such capsules. However, if the capsules are made such that they are more easily breakable for the user, the capsules rupture more easily during the manufacturing process, causing difficulties for the manufacturer.

[0005] Conventional breakable capsules typically comprise an essentially free-flowing liquid core of negligible mechanical strength and an external shell of sufficient rigidity to survive the manufacturing process of the smoking article filters and smoking article such as cigarettes. This results in the capsules often being difficult to rupture in the smoking article filters, requiring much effort from the user and often causes visible damage to the integrity of the smoking article.

[0006] Hence, an object of the present invention is to provide a new, easily breakable capsule for smoking articles but which can undergo strong mechanical stresses applied during the manufacture of smoking article filters and smoking articles.

[0007] According to the present invention there is provided a method of forming a breakable capsule comprising the steps of:

- (i) providing the core of the capsule,
- (ii) providing said core with a capsule envelope to form said capsule, and
- (iii) freezing said capsule,

wherein step (iii) may be performed before or after step (ii).

[0008] The term "capsule" as used herein refers to a delivery system of a substance, said substance being hereinafter referred to as "the core" which is enclosed in a capsule envelope.

[0009] The term "breakable capsule" refers to a capsule wherein the capsule envelope can be broken by means of a pressure to release the core, more specifically, the capsule envelope can be ruptured under the

pressure imposed by the smoker's fingers when the smoker wants to release the core of the capsule.

[0010] The method of the invention advantageously comprises a freezing step to freeze the content, the core of the capsule and/or its envelope. Freezing the capsule allows for use of breakable capsules having low crush strength as the freezing of the capsule's core provides sufficient strength to the capsule to undergo the manufacturing process of smoking article filters and smoking articles such as cigarettes comprising such breakable capsule in the filter.

[0011] A typical manufacturing process of smoking article filters comprising a breakable capsule sees a capsule being introduced or fed from a reservoir into the stream of filter tow prior to its passing through the garniture which forms the filter rod. The presence of the capsule naturally creates its own space within the filter by displacing the filter tow and results in a snug fit. Hence once inserted within the filter material, the capsule is largely insulated from external forces by the surrounding filter tow. Therefore breakable capsules only need to have high crush strength to prevent unwanted capsule rupture during manufacture of smoking article filters, but can and need to show much lower crush strength throughout the remainder of the product lifecycle.

[0012] The use of a frozen capsule during the manufacturing process of smoking article filters provides capsules with sufficient mechanical strength during this critical period. However, once the capsules melt and return to their original state, they have a softer shell than conventional breakable capsules, thus allowing the user of smoking articles to break the capsules more easily under a digital pressure on the filter.

[0013] With the method and capsule of the present invention, it is possible to provide to a smoking article which comprises a breakable capsule which is not only easy to manufacture (i.e. minimising rupture) but also easily breakable by the user.

[0014] According to the invention, the core of the breakable capsule as provided in step (i) comprises at least water, propylene glycol, glycerol, ethanol, polyethylene glycols or any combination thereof. Preferably, the core comprises at most 50 % water by total weight of the capsule, preferably less than 50% water by total weight of the capsule to control expansion of the capsule core in the frozen state. Alternatively, the core of the breakable capsule of the invention may also comprise a base of oil (e.g. Mygliol ®) and ethanol as described in EP 1 906 775 B1.

[0015] In addition, the core of the capsule may contain flavour and aroma compounds such as those typically used in tobacco products (fruity, floral, menthol, vanilla, coffee, chocolate, cinnamon etc.), smoke modifying agents such as acids and bases and solubilising / emulsifying agents (such as surfactants), gelling agents and other stabilising agents (such as preservatives).

[0016] Unlike conventional capsules, in the present invention, the structural integrity required for the capsule

to survive the manufacturing process of smoking article filters and smoking articles comes from the solidified contents; the actual structural rigidity of the envelope material being largely irrelevant. As the rigidity of the envelope is not critical to overall performance, a wider range of materials can be used to produce the envelope, e.g. thin plastics like polyolefins.

[0017] Use of such plastics combined with liquid fill is advantageous as it can reduce capsule cost, provide superior capsule manufacturing processes and use a wider range of materials. Typically capsules are manufactured by a co-extrusion method as described in EP 1 906 775 B1 whereby the core liquid is extruded within a liquid envelope. This envelope is then hardened by cooling, crosslinking, etc. and often a final barrier layer is then applied to protect the envelope from moisture ingress, etc.

[0018] Such a process places limitations upon the materials used, for example the liquid core and the envelope must not be miscible otherwise crossover can occur which can result in compromising both the mechanical properties of the envelope and the retention of the volatiles within the envelope. In a typical capsule configuration, the inner liquid core is hydrophobic and the envelope hydrophilic; whilst this adequately prevents mixing it also means that the envelope material is vulnerable to attack by moisture, resulting in softening and potential rupture. Often moisture ingress is prevented by applying an external glaze, which adds an extra step and additional ingredients to the manufacturing process. Such capsules cannot use water within the liquid core, meaning such technology cannot add water to the smoke upon activation nor can it use water soluble flavours.

[0019] Whilst co-extrusion equipment is widely known in the art, it is also relatively complex and expensive.

[0020] The capsule envelope of the present invention requires only to be impermeable to the liquid core to prevent leakage before freezing and after melting and until activation by an end user. However, the capsule envelope should be sufficiently flexible to survive the volume expansion at freezing and contraction upon melting without losing integrity.

[0021] Accordingly, suitable materials for use as the capsule envelope include, but not limited to, polymers selected from the group consisting of polyolefin, polyacetal, polyamide, polyimide, polyester, polycarbonate, polyacrylate, elastomer, natural rubber, synthetic rubber, polystyrene, polyvinylacetate, polyvinylalcohol, polyvinylchloride and combinations thereof. In a preferred embodiment, a polyolefin material particularly, polyethylene is used since it is widely compatible with both hydrophobic and hydrophilic liquids including water.

[0022] The thickness of the capsule envelope may be between 0.01 and 0.5 mm, preferably between 0.01 and 0.1 mm, and even more preferably between 0.01 and 0.05 mm.

[0023] The weight of the capsule envelope is preferably between 5 and 50%, more preferably between 10 and

20% by total weight of the capsule.

[0024] The ability of the capsule to rupture is measured through the crush strength to be exerted to rupture the capsule. The crush strength of the capsule can for example be measured using a LLOYD LFPlus Series Digital Material Tester having a 100N load cell.

[0025] The capsule according to the present invention preferably has a crush strength of between 0.5 and 5 kp when the core of the capsule is in a frozen state. More preferably, the crush strength of the capsule is between 1 and 3 kp, when the core of the capsule is in the frozen state.

[0026] The capsule according to the present invention preferably has a crush strength of between 0.1 and 0.4 kp when the core of the capsule is in a melted/liquid state. More preferably, the crush strength of the capsule is between 0.1 and 0.3 kp, at room temperature. In the present specification the terms "room temperature" mean a temperature comprised in range of about 10 to 30 °C.

[0027] The capsule may take any shape which would be known to those skilled in the art, depending on the manufacturing process. For example, the capsule may be spherical, ellipsoidal, cylindrical, cubic or cuboidal. Preferably the capsule is spherical or ellipsoidal.

[0028] Moreover, the capsule preferably has a largest outer dimension of between 2 and 20 mm, more preferably between 4 and 15 mm, and even more preferably between 4 and 10 mm.

[0029] When the capsule is non-spherical in shape, it is preferably elongated along a longitudinal direction x wherein the outer dimension is of between 2 and 20 mm, more preferably between 4 and 15 mm, and even more preferably between 4 and 10 mm. In addition, the outer dimension of the capsule in a direction transverse to said longitudinal direction x is of between 2 and 10 mm, more preferably between 3 and 5 mm, and even more preferably between 3 and 4 mm.

[0030] Finally, the total weight of the capsule according to the invention is preferably between 5 and 60 mg, more preferably between 10 and 50 mg and even more preferably between 20 and 40 mg.

Brief Description of the Drawings

[0031]

Figure 1A and 1B represent flow diagrams outlining preferred manufacturing processes for making breakable capsules according to the present invention; and

Figure 2A to 2F show various shapes and forms that a breakable capsule according to the invention may take.

[0032] The following provides preferred methods for making the capsules of the present invention.

[0033] As shown in the flow diagram in Figure 1A, a breakable capsule according to the present invention

may be formed by first providing a liquid core which contains at least 70% water, propylene glycol, glycerol, ethanol, polyethylene glycols or any combination thereof. The core may further comprise flavour and aroma compounds, smoke modifying agents, gelling agents and other stabilising agents.

[0034] A capsule envelope of desired shape and size is then formed, and the envelope is filled with the liquid core. The liquid core is then frozen into the capsule envelope to form the final capsule.

[0035] The capsule in its frozen state is then introduced into the filter to provide the assembled filters comprising the capsule. These filters are then incorporated into cigarettes to provide a cigarette containing the breakable capsule.

[0036] In an alternative method as shown in the flow diagram in Figure 1B, the liquid core which is formed as described above, may be poured into molds of desired shape and size to provide filled molds containing the liquid core. The core is then frozen into the desired shape and size. Once the core is removed from the molds, a capsule envelope is formed around the frozen core to provide the final capsule.

[0037] The capsule may then be introduced into the filter and subsequently the cigarette in the same manner as described for the earlier method.

[0038] The capsule containing the liquid core as described above may take any form. In particular, it may be spherical, as shown in Figure 2A, ellipsoidal as shown in Figure 2B or cylindrical, as shown in Figure 2C. The capsule may further be in the form of a blister pack as shown in Figure 2D, a pillow pack as shown in Figure 2E or a stick or tube pack as shown in Figure 2F.

[0039] The term "blister pack" as used herein refers to a sealed bubble or pouch for enclosing the liquid core. The term "pillow pack" includes a pack which is formed from one sheet by providing a core in the centre of the sheet. The sheet is then subsequently folded over and sealed on the remaining three sides. It may also refer to a pack which is formed by providing a core in the centre of one sheet, and then placing a further sheet on top of the first sheet such that the core is enclosed. Subsequent sealing of all sides around the core provides the desired capsule. The term "tube pack" as used herein refers to a pack which is formed from a continuous tube of material, into which the core may be inserted and then sealed on either end of the core. The tube pack may further include those that are formed by placing a core in the centre of a sheet which is subsequently rolled to enclose the core and then sealed along the longitudinal line to form a sealed tube. The ends on either side of the core may then subsequently be sealed to form the capsule.

[0040] The capsule envelope may be formed from any material and in any thickness as described herein. In particular, the capsule envelope is formed from polyethylene with a thickness of between 0.01 and 0.05 mm.

[0041] The breakable capsule may take any shape, size and crush strength as described herein.

[0042] In a preferred method, a polyolefin film of thickness 0.025mm is formed into a continuous tube by creating a continuous longitudinal seal. One end of the tube is then sealed and the liquid contents are introduced. The top is then sealed to form a stick pack. The stick pack may then be cut into individual capsules or the continuous strip of capsule may be retained to ease subsequent handling in later manufacturing steps.

[0043] In another preferred method, using a similar film, a three sided pocket is formed via heat seals. The liquid contents are then introduced via injection and the fourth side is heat sealed to form a pillow pack with liquid contents.

[0044] In yet another method, a thermoform plastic may be shaped into blisters, and the liquid may be introduced. The top layer may then be sealed onto the plastic base. Individual blisters / capsule can then be cut out or retained en masse as above.

[0045] In a further method, the contents of the core may be frozen into the required shape using moulds. The frozen core may then be introduced into pre-formed plastic tubing or between layers of capsule envelope material, and then sealed. Individual blisters / capsule can then be cut out or retained en masse as above. Depending on the particular manufacturing process, the core of the capsule may then be left to melt, and then subsequently frozen again, prior to insertion into the filter / smoking article.

[0046] In yet another method, the contents of the core may be frozen into the required shape using moulds. The frozen core may then be coated with a liquid capsule envelope material along with a hardener and/or crosslinking agent. The capsule envelope coating may then be cured to provide individual capsules containing the core. Depending on the particular manufacturing process, the core of the capsule may then be left to melt, and then subsequently frozen again, prior to insertion into the filter / smoking article.

[0047] The freezing/solidifying temperature will be dependent upon the composition of the liquid contents. Pure water will freeze at 0°C, whereas, a mixture of water & propylene glycol will freeze in the range of approximately 0°C ~ -39°C depending on the specific composition of the mixture. Dissolved solutes may also depress the freezing temperature.

[0048] The inclusion of >10% propylene glycol will have the added advantage of being a better carrier for hydrophobic flavours.

[0049] Due to the very low temperature of freezing for ethanol (-115°C) this is best avoided as a predominant component of the liquid contents.

[0050] The method of introducing a frozen capsule into a smoking article is not particularly limiting, so long as it comprises the steps of providing a frozen capsule formed according to the method described above, and inserting said capsule inside the tip of a smoking article.

[0051] The freezing step to incorporate the capsule into the smoking article may be carried out at any time after the manufacture of the capsule and before insertion into

the filter / smoking article. Frozen capsules described above are stable, easy to handle and transport. Although the melting process does not happen rapidly, it is preferable that any equipment contacting the frozen capsule prior to insertion such as reservoirs is refrigerated for ease of handling.

[0052] The present invention is also directed to a breakable capsule for a smoking article having a crush strength of 0.1 to 0.4 kp and a filter for a smoking article comprising such a capsule.

[0053] The present invention also includes smoking articles comprising a tip containing a capsule and the use of the capsule formed by the described method in a smoking article.

Claims

1. A method of forming a breakable capsule for a smoking article comprising the steps of:

- (i) providing the core of the capsule,
 - (ii) providing said core with a capsule envelope to form said capsule, and
 - (iii) freezing said capsule,
- wherein step (iii) may be performed before or after step (ii).

2. The method according to claim 1, wherein said core in step (i) comprises water, propylene glycol, glycerol, ethanol, polyethylene glycols, an oil or any combination thereof.

3. The method according to claim 2, wherein said core comprises at most 50% water by total weight of the capsule.

4. A method according to claim 1 or claim 2, wherein said capsule envelope comprises a polymer selected from the group consisting of polyolefin, polyacetal, polyamide, polyimide, polyester, polycarbonate, polyacrylate, elastomer, natural rubber, synthetic rubber, polystyrene, polyvinylacetate, polyvinylalcohol, polyvinylchloride and combinations thereof, preferably polyolefin.

5. The method according to any preceding claim, wherein said capsule envelope has a thickness of between 0.01 and 0.5 mm.

6. The method according to any preceding claim wherein the largest outer diameter of the capsule is between 2 and 20 mm, preferably 4 and 15 mm, more preferably between 4 and 15 mm.

7. The method according to any preceding claim, wherein the core of said capsule further comprises flavour compounds, aroma compounds, smoke

modifying agents solubilising agents, emulsifying agents, gelling agents, stabilising agents or combinations thereof.

8. A method of introducing a frozen capsule into a filter for a smoking article comprising the steps of:

- providing a frozen capsule formed according to any of claims 1 to 7, and
- inserting said capsule inside a smoking article filter rod.

9. A breakable capsule for a smoking article having a liquid core and a capsule envelope around the core, and having a crush strength of 0.1 to 0.4 kp at room temperature.

10. A filter for a smoking article comprising the capsule according to claim 9.

11. A smoking article comprising a filter according to claim 10.

12. Use of the capsule formed by the method according to any of claims 1 to 7 in a smoking article.

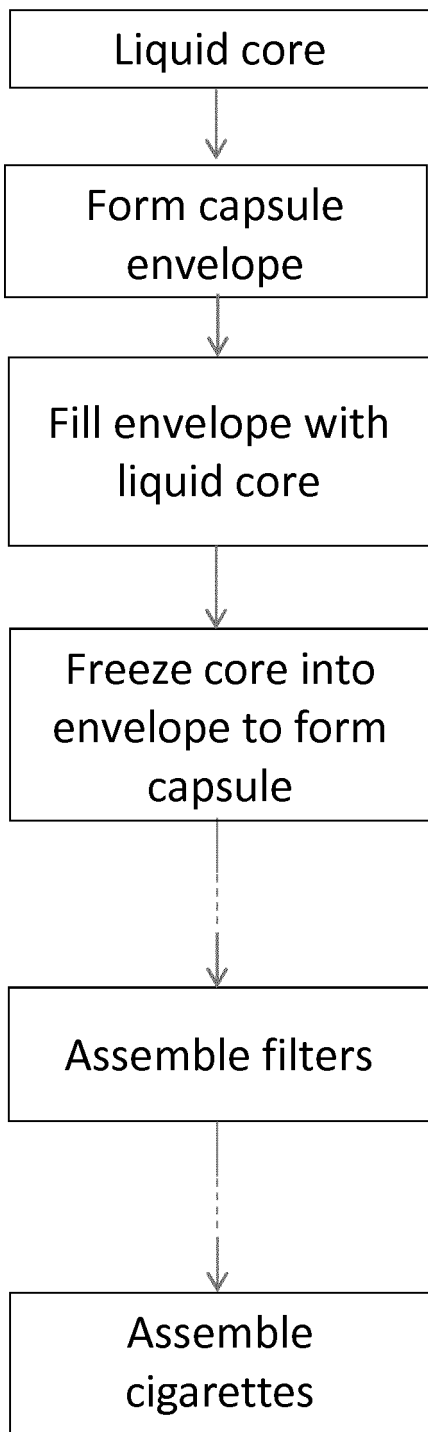


Figure 1A

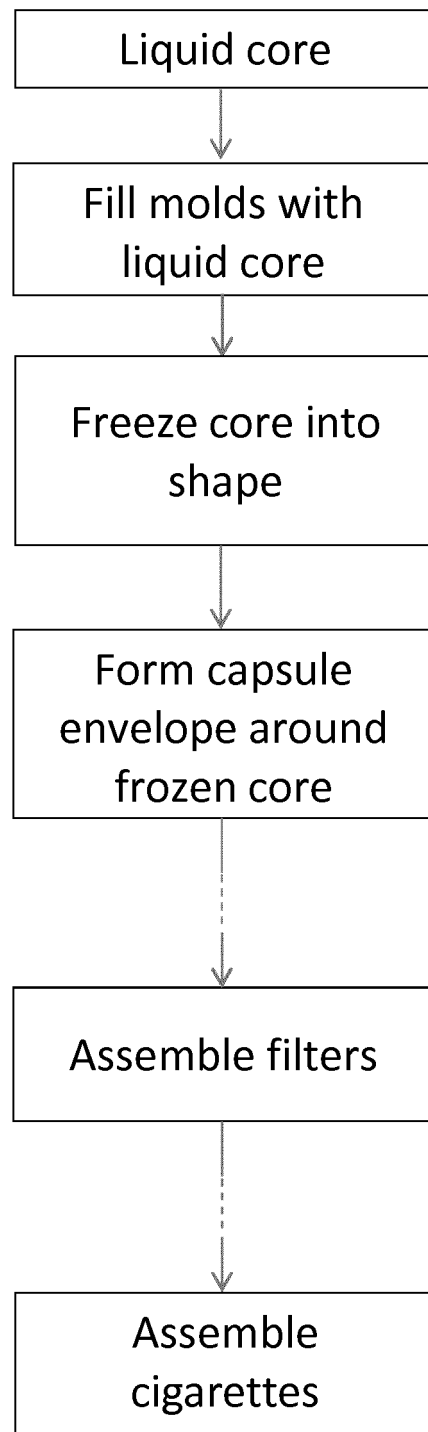


Figure 1B

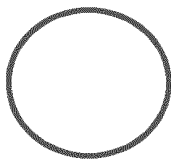


Fig. 2A



Fig. 2B



Fig. 2C



Fig. 2D



Fig. 2E



Fig. 2F



EUROPEAN SEARCH REPORT

Application Number
EP 12 19 7703

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 614 851 A (GREEN SYDNEY JAMES) 26 October 1971 (1971-10-26) * column 1, line 13 - column 2, line 11 * * examples I, II *	1-12	INV. A24B15/28 A24D3/06
X	EP 0 649 607 A2 (BRITISH AMERICAN TOBACCO CO [GB]) 26 April 1995 (1995-04-26) * page 2, line 1 - line 9 * * page 5, line 38 - page 6, line 8 *	1-12	
X	US 3 693 369 A (HORSEWELL HENRY GEORGE ET AL) 26 September 1972 (1972-09-26) * column 1, line 3 - line 61 * * column 2, line 21 - line 64 *	1-12	
X	WO 2011/077141 A1 (BRITISH AMERICAN TOBACCO CO [GB]; RUSHFORTH DAVID [GB]) 30 June 2011 (2011-06-30) * page 3, line 20 - line 28 * * page 5, line 28 - line 33 * * page 8, line 23 - line 25 * * page 10, line 21 - line 26 * * page 12, line 16 - line 22 * * page 15, line 8 - line 12 *	1-12	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A24B A24D
Place of search		Date of completion of the search	Examiner
The Hague		25 March 2013	Dimoula, Kerasina
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 19 7703

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-03-2013

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3614851	A	26-10-1971	CH 490996 A	31-05-1970
			DE 1919599 A1	30-10-1969
			GB 1234802 A	09-06-1971
			US 3614851 A	26-10-1971

EP 0649607	A2	26-04-1995	AT 198261 T	15-01-2001
			AT 235171 T	15-04-2003
			AU 675573 B2	06-02-1997
			AU 7416294 A	13-04-1995
			BR 9403650 A	30-05-1995
			DE 69426480 D1	01-02-2001
			DE 69426480 T2	19-04-2001
			DE 69432372 D1	30-04-2003
			DE 69432372 T2	23-10-2003
			DK 649607 T3	29-01-2001
			DK 0920816 T3	22-04-2003
			EP 0649607 A2	26-04-1995
			EP 0920816 A2	09-06-1999
			ES 2152969 T3	16-02-2001
			ES 2193465 T3	01-11-2003
			GR 3035202 T3	30-04-2001
			JP 3744953 B2	15-02-2006
			JP H07250665 A	03-10-1995
			JP 2003304856 A	28-10-2003
			PT 649607 E	30-04-2001
			PT 920816 E	31-07-2003
			US 2003098033 A1	29-05-2003
			US 2004074507 A1	22-04-2004

US 3693369	A	26-09-1972	BE 747879 A1	31-08-1970
			CH 507840 A	31-05-1971
			DE 2013934 A1	08-10-1970
			GB 1267272 A	15-03-1972
			NL 7004166 A	28-09-1970
			US 3693369 A	26-09-1972

WO 2011077141	A1	30-06-2011	AR 081053 A1	06-06-2012
			AU 2010334634 A1	19-07-2012
			CA 2784479 A1	30-06-2011
			CN 102781265 A	14-11-2012
			EP 2515688 A1	31-10-2012
			KR 20120103727 A	19-09-2012
			US 2013047999 A1	28-02-2013
			WO 2011077141 A1	30-06-2011

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1906775 B1 [0014] [0017]