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(54) Title: EYE SURGICAL INSTRUMENT AND EYE SURGICAL SET

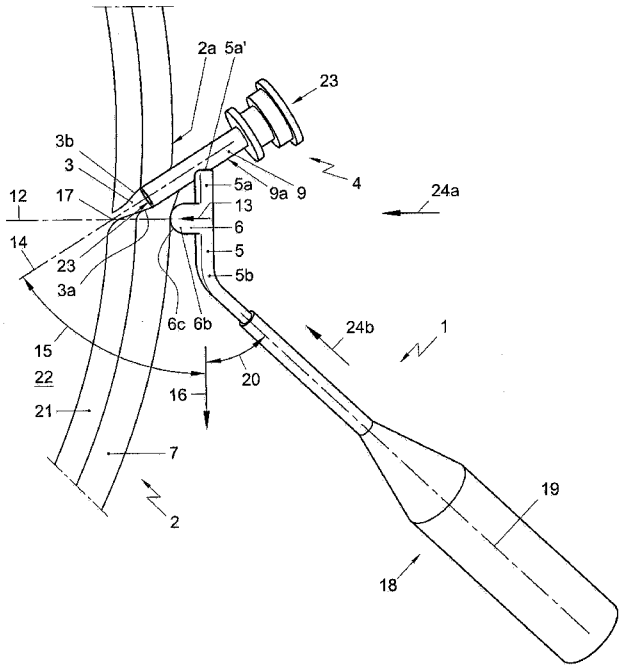


Fig. 1

(57) Abstract: The invention relates to an eye surgical instrument for at least partly pressing closed an incision provided in an eye during and/or after removal of a cannula from the incision. The instrument comprises a substantially elongated supporting arm. Further, the instrument comprises a press-on part connected with the supporting arm, which is designed to enable a pressure force to be exerted on the conjunctiva of an eye. The press-on part extends sidewards away from the supporting arm.

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Title: **EYE SURGICAL INSTRUMENT AND EYE SURGICAL SET**

The invention relates to an eye surgical instrument for at least partly pressing closed an incision made in an eye during and/or after removal of a cannula from the incision.

During an eye surgical procedure, often an incision is created in an eye, which incision can run through the conjunctiva and sclera. Often, a cannula is introduced into this incision, through which a variety of instruments can be inserted into the eye. Following surgery, the cannula is removed from the eye again. Typically, this is done by grasping the cannula with a pair of tweezers and then pulling it out of the incision. However, owing to the cylindrical shape of the cannula, the incision is deformed, as a result of which it may remain open. This results in pressure loss, as fluid can leak from the eye. For this reason, in practice, the incision is often pressed closed when the cannula is out.

To this end, often cotton swabs are used. Also, sometimes scleral depressors are used, but these are not intended for that purpose, nor are they suitable for it.

Moreover, in practice, it often proves to be difficult to properly press closed the incision. Often, after removing the cannula, the surgeon can see the incision only poorly or cannot see it well. For this reason, the surgeon often proceeds to rub haphazardly over a relatively large surface. The surgeon thus cannot exert any directed pressure. Moreover, the risk of injury on the outside of the eye increases when a relatively large surface is being worked. Also, it is disadvantageous that the pressure of the eye can continue to decrease until the incision is finally pressed closed sufficiently.

Moreover, handling a cotton swab requires the necessary skill. Accordingly, it may be very difficult to exert a proper pressure force on the conjunctiva. Consequently, it may happen that the opening does not close properly, so that leakage may arise or pressure loss may continue to occur.

This is to say that fluid can continue to run out of the eye and/or that the pressure in the eye continues to decrease unintentionally.

The invention contemplates providing an eye surgical instrument. In particular, the invention contemplates obtaining an eye surgical instrument whereby at least one of the disadvantages mentioned is counteracted. To this end, the instrument comprises a substantially elongate supporting arm and a press-on part connected with the supporting arm, which is designed to enable a pressure force to be exerted on the conjunctiva of an eye, the press-on part being connected to the supporting arm such that the press-on part extends sidewards away from the supporting arm.

Due to the press-on part extending sidewards away from the supporting arm, a surgeon does not need to press the substantially elongated supporting arm in its longitudinal direction towards the eye, but the surgeon can press the supporting arm substantially sidewards towards the eye to have the press-on part exert a greater pressure force on the conjunctiva. As a result, the eye surgical instrument becomes relatively easy to handle and it becomes relatively simple to exert sufficient pressure force on the conjunctiva.

In a preferred embodiment, a first end of the substantially elongated supporting arm is provided with an indentation for receiving a portion of a cylindrical tube of a cannula. As a result, the tube can be guided while being removed from the eye. Guiding of the tube of the cannula can, for instance, prevent the opening provided in the eye by an incision from tearing during removal of the tube.

An additional advantage can be that the press-on part during removal of the tube of the cannula can be relatively simply held at a constant distance from the tube and hence from the incision. Consequently, relatively simply, the conjunctiva can be pressed upon at the right spot, and

since the distance to the incision can be kept the same, it can hence become simpler to apply the right pressure force.

The invention further relates to an eye surgical set, comprising at least one cannula and an eye surgical instrument.

Advantageous embodiments of the invention are represented in the description and in the subclaims.

The invention will be elucidated in more detail on the basis of exemplary embodiments which are represented in the drawings. In the drawings:

Figure 1 shows a schematic view of a first embodiment of a surgical instrument according to the invention and a cross section of a portion of an eye; and

Figure 2 shows a schematic perspective view of a part of a second embodiment of a surgical instrument according to the invention.

The Figures are only schematic representations of preferred embodiments of the invention. In the Figures, like or corresponding parts are denoted with the same reference numerals.

Fig. 1 shows a schematic view of a first embodiment of a surgical instrument 1 according to the invention and a cross section of a portion of an eye 2.

In the eye 2 shown, an incision 3 has been provided in the conjunctiva 7 and the sclera 21. The incision, as is represented in Fig. 1, can be an oblique slit incision 3, which is also referred to as oblique step incision 3. This is to say that the plane of the incision 3 is not perpendicular to the outer surface 2a of the eye 2, but is actually oblique. Accordingly, the oblique slit incision 3 is at an angle to the local outer surface 2a of the eye 2.

In the incision 3 a cannula 4 may be placed. The cannula 4 here has a hollow tube 9 which provides a passage 23 to permit medicaments and/or tools at least partly to be introduced into the eye, for instance, into the posterior chamber and/or the vitreous body 22 of the eye.

The surgical instrument 1 shown is suitable for at least partly pressing closed an incision 3 provided in an eye 2 during and/or after removal of a cannula 4 from the incision 3. The instrument 1 comprises a substantially elongated supporting arm 5 and a press-on part 6 connected with the supporting arm 5. The press-on part 6 is designed to enable a pressure force to be exerted on the conjunctiva 7 of the eye 2. The press-on part 6 extends sidewards away from the supporting arm 5. Preferably, the press-on part 6 is substantially transverse to the supporting arm.

The press-on part may be of substantially circular cylindrical design. Here, an axis 12 of the press-on part extends from the supporting arm 5 in the direction 13 in which the press-on part 6 extends from the supporting arm 5. The press-on part 6 can comprise a press-on tip 6b having a spherical press-on surface 6c. Thus, in virtually any orientation the press-on surface 6c can simply maintain abutment with the outside 2a of the eye, hence without a turning of the instrument 1 resulting in the press-on surface 6c being incorrectly positioned. Alternatively, the press-on part 6, as is shown in Fig. 2, can have a substantially flat press-on surface 6c, or the press-on surface 6c may be, for example, concave, for instance to conform relatively well to the curvature of the outside 2a of the eye 2.

In a specific embodiment a first end 5a of the substantially elongated supporting arm 5 is provided with an indentation, not shown in Fig. 1, for receiving a portion of a cylindrical hollow tube 9 of the cannula 4.

The indentation 8 is visible in Fig. 2 which shows a schematic perspective view of a part of a second embodiment of a surgical instrument 1 according to the invention. This second embodiment differs chiefly from the first embodiment shown in Fig. 1 in that the press-on part 6 is differently shaped.

In the example shown, the indentation 8 is provided with a sharp edge 10. The sharp edge 10 can scrape tissue off a portion of a cylindrical tube 9 of the cannula 4. In this way, for instance, the cannula may thus be

prevented from entraining tissue, such as tissue of the vitreous body of the eye, out of the eye too far.

The indentation 8 is here bounded by a boundary surface 11 which forms a part of an imaginary circular cylinder.

Preferably, an axis 12 of the press-on part 6 and a central axis 14 of the circular cylinder are at an angle 15 with respect to each other, such that the axes 12, 14 mutually intersect on the side of the supporting arm 5 where the press-on part 6 is placed. In other words, the central axis 14 of the imaginary circular cylinder is preferably at such an angle 15 with the direction 16, in which the substantially elongated supporting arm 5 extends, that the central axis 14 of the circular cylinder intersects the axis 12 of the press-on part 6. In the Figures, this occurs at point of intersection 17. The angle 15 between the direction 16 of the supporting arm and the central axis 14 of the circular cylinder and/or an angle 18 between the two axes 12, 14 can be, for example, between 30° and 60°, for example, between 40° and 50°, for example, at about 45°.

Owing to this, the guide surface 11 can hence be placed such that this surface conforms well to a side 9a, remote from the eye, of the tube 9 of the obliquely positioned cannula 4 to be removed. Consequently, the press-on part 6 is then placed on a side of the incision 3 where the press-on part 6 can press the - viewed in a press-on direction 24 - substantially superjacent wall 3a towards the opposite wall 3b. The press-on direction 24a can be, for example, substantially perpendicular to the local outer surface 2a of the eye 2. Alternatively, the press-on direction 24b can be, for example, substantially perpendicular to the direction of the incision 3, or the press-on direction 24 may be in the range of these two examples 24a, 24b.

It is noted that the instrument 1 can be used not only during the removal of a cannula 4 from the eye 2. The eye surgical instrument 1 may alternatively or additionally be used, for instance, to press closed the incision 1 after removal of a cannula 4 and/or to massage the eye 2 locally.

Preferably, the press-on part 6, viewed in the longitudinal direction 16 of the supporting arm 5, is located remote from the first end 5a of the supporting arm 5. Thus, measured in the longitudinal direction 16 of the supporting arm 5, the distance from an extreme tip 5a' of the end 5a to an axis 12 of the press-on part 6 can be between about 0.5 and 30 mm, for example, about 0.5, 0.75, 1, 1.25, 1.5, 2, 2.5, 3, 4, 5, 7.5, 10, 15, 20, 25, or 30 mm.

In a preferred embodiment the eye surgical instrument 1 is designed such that the longitudinal direction 16 of the supporting arm 5 during normal use is substantially parallel to the local outer surface 2a of the eye 2.

As shown in Fig. 1, a second end 5b of the substantially elongated supporting arm 5 may be coupled to a handle 18. Here, an axis 19 of the handle 18 is at an angle 20 with respect to the direction 16 in which the substantially elongated supporting arm 5 extends. As a result, the freedom of movement of the instrument 1 can increase and the ease of handling it can be augmented.

As already indicated above, the figures are only schematic representations. Dimensions and ratios in the drawings are not representative. Thus, for instance, the handle 18 may in reality be much greater than the eye 2.

The eye surgical instrument 1 can be used during removal of the cannula 4. The cylindrical boundary surface 11 can be placed against the side 9a, remote from the eye, of the tube 9 of the cannula, and can guide the cannula 4 while it is being withdrawn from the eye. Also, in this way, the press-on part 6 can be kept in the proper place. For when the instrument 1 is guided along the tube towards the eye, it can end up at the right spot. So then a start is made with pressing closed the incision 3 during removal of the cannula or substantially directly after removal of the cannula. As a

result, pressure loss can be minimal and failure to locate the incision 3 can be obviated.

It is noted that the eye surgical instrument 1 and the cannula 4 can form a set 1, 4. Accordingly, the instrument 1 can be offered, for instance, together with one or a plurality of cannulas 4, while the radius of the cylindrical tube 9 of the cannula 4 preferably corresponds substantially to the radius of the cylindrical boundary surface 11 of the indentation 8 of the eye surgical instrument 1.

Further, it is noted that the supporting arm 5 and/or the press-on part 6 is/are preferably manufactured from stainless steel, so that an easily sterilizable product can be obtained.

The invention is not limited to the exemplary embodiments described here. Many variants are possible.

Thus, the supporting arm 5 and/or the press-on part 6 may be manufactured from other materials, for example, from titanium and/or plastic.

Similar and other variants will be clear to one skilled in the art and are understood to be within the scope of the invention, as set forth in the following claims.

CLAIMS

1. Eye surgical instrument for at least partly pressing closed an incision provided in an eye during and/or after removal of a cannula from the incision, comprising:

a substantially elongated supporting arm; and

a press-on part connected with the supporting arm, which is designed to enable a pressure force to be exerted on the conjunctiva of an eye, the press-on part extending sidewards away from the supporting arm.

2. An eye surgical instrument according to claim 1, wherein a first end of the substantially elongated supporting arm is provided with an indentation for receiving a portion of a cylindrical tube of a cannula.

3. An eye surgical instrument according to claim 2, wherein the indentation is bounded by a boundary surface that forms part of a circular cylinder.

4. An eye surgical instrument according to claim 3, wherein an axis of the press-on part and a central axis of the circular cylinder are at an angle with respect to each other, such that they mutually intersect on the side of the supporting arm where the press-on part is placed.

5. An eye surgical instrument according to any one of the preceding claims, wherein the press-on part comprises a press-on tip having a spherical press-on surface.

6. An eye surgical instrument according to any one of the preceding claims, wherein a second end of the substantially elongated supporting arm is coupled to a handle, preferably such that an axis of the handle is at an angle with respect to the direction in which the substantially elongated supporting arm extends.

7. An eye surgical instrument according to any one of the preceding claims, wherein the indentation is designed to guide a tube of a cannula,

preferably with the radius of the cylindrical tube of the cannula substantially corresponding to the radius of the cylindrical boundary surface of the indentation.

8. An eye surgical set, comprising:

at least one cannula; and

an eye surgical instrument according to any one of the preceding claims.

9. An eye surgical set according to claim 8, wherein the cannula comprises a cylindrical tube for insertion into an incision in an eye, wherein a first end of a substantially elongated supporting arm of the eye surgical instrument is provided with an indentation bounded by a boundary surface that forms a part of a circular cylinder, and wherein the radius of the cylindrical tube of the cannula substantially corresponds to the radius of the cylindrical boundary surface of the indentation of the eye surgical instrument.

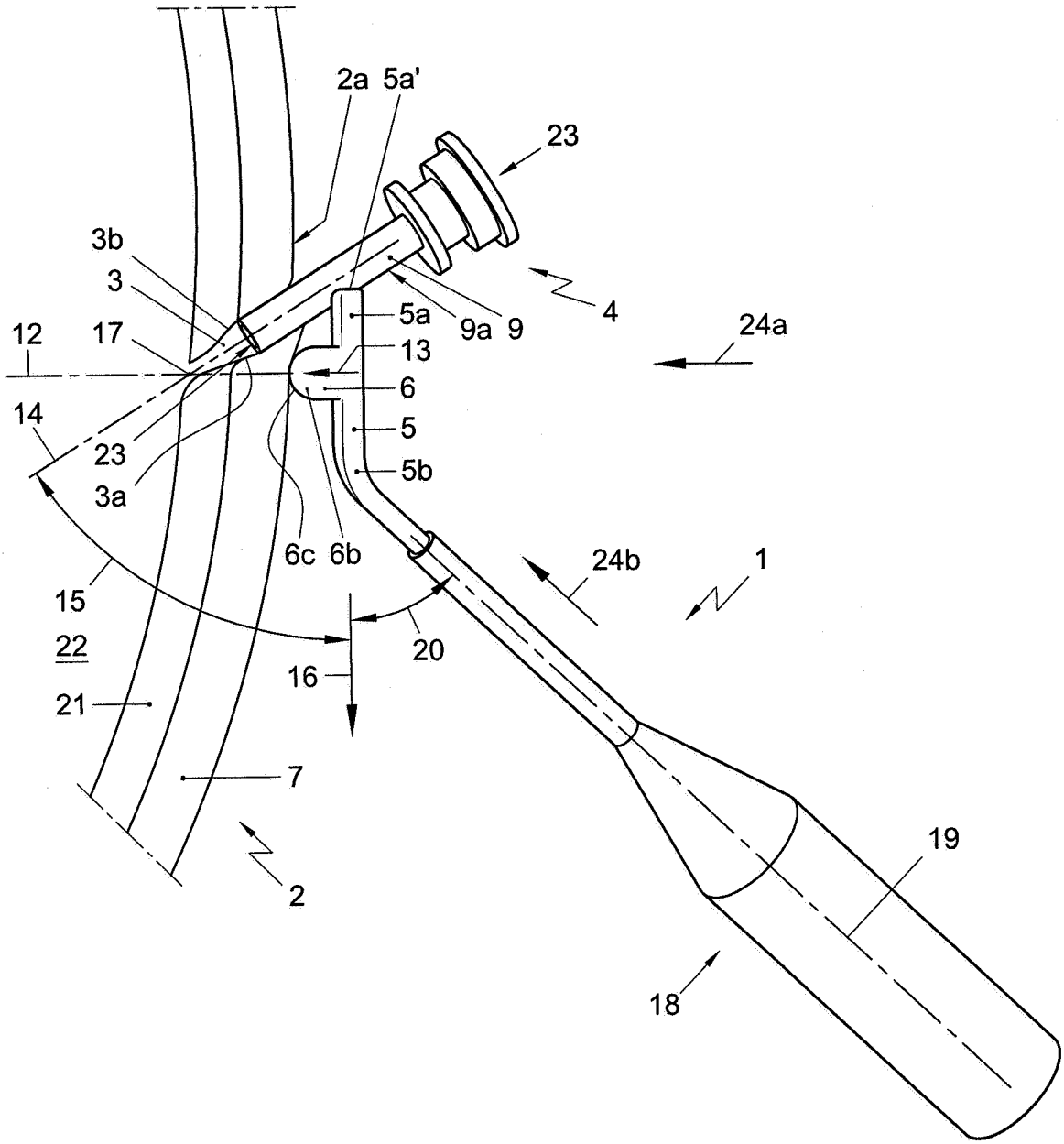

2a
5a'
23
3b
3
12
17
5a
9a
9
4
24a
13
6
5
5b
14
23
3a
6c
6b
24b
1
15
22
20
16
21
7
2
19
18

Fig. 1

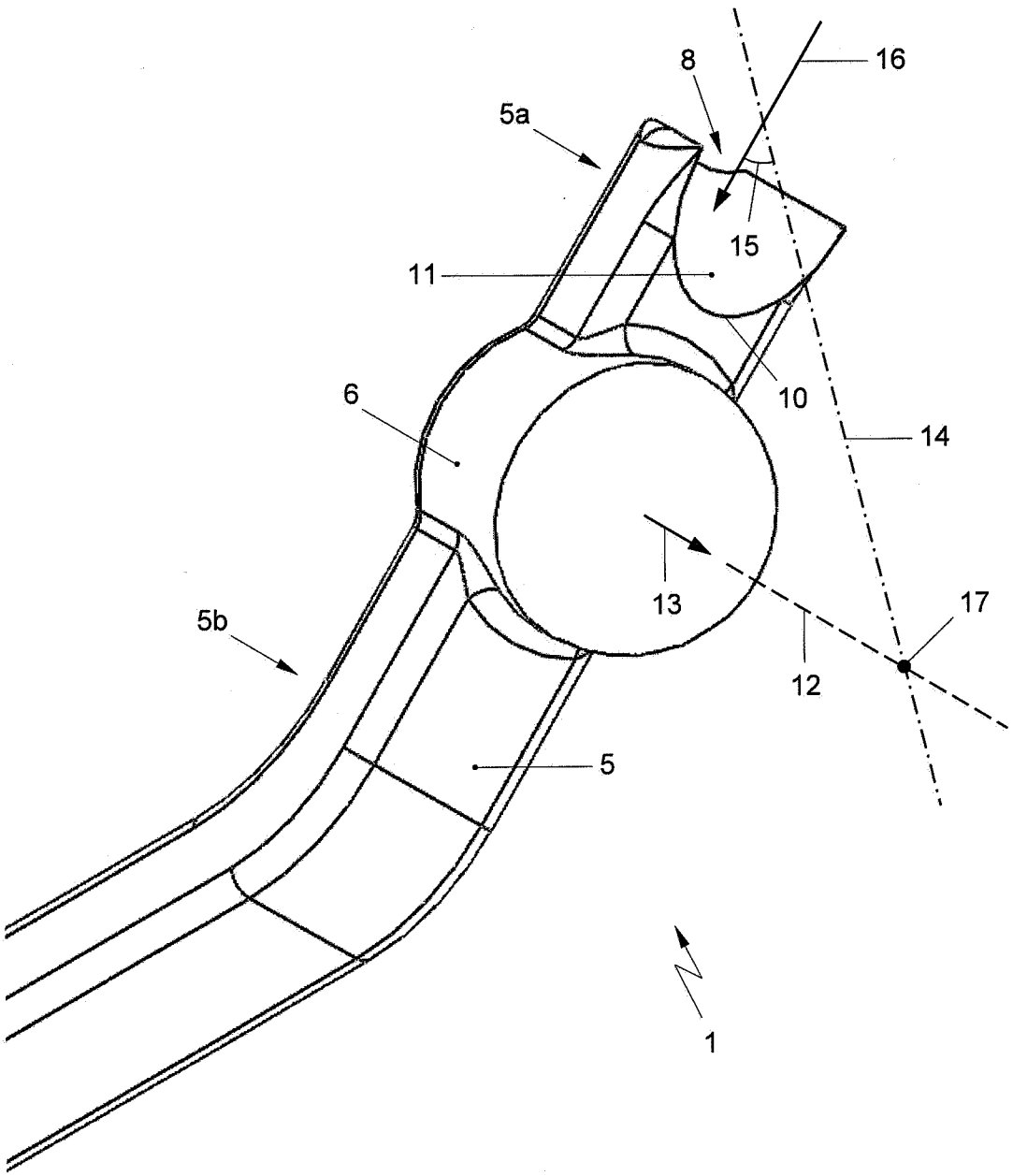


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050149

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B17/00 A61F9/007 A61B17/12
ADD. A61F9/00

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)
A61B A61F

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 10 2005 008235 A1 (THYZEL REINHARDT [DE]) 31 August 2006 (2006-08-31) paragraph [0062] - paragraph [0068]; figures	1,8
A	US 2011/288525 A1 (HALLEN PAUL [US] ET AL) 24 November 2011 (2011-11-24) paragraph [0015] - paragraph [0017]; figures	1,8
A	GB 2 458 181 A (INSITU THERAPEUTICS INC [US]) 9 September 2009 (2009-09-09) paragraph [0054] - paragraph [0055]; figures	1,8

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"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	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102005008235 A1	31-08-2006	AT 499915 T	15-03-2011
		DE 102005008235 A1	31-08-2006
		EP 1858459 A1	28-11-2007
		ES 2362174 T3	29-06-2011
		JP 2008531077 A	14-08-2008
		US 2008281277 A1	13-11-2008
		US 2011230890 A1	22-09-2011
		WO 2006089611 A1	31-08-2006
US 2011288525 A1	24-11-2011	NONE	
GB 2458181 A	09-09-2009	GB 2458181 A	09-09-2009
		US 2009227938 A1	10-09-2009
		WO 2009111065 A1	11-09-2009