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(54) **IONISER**

(57) An ioniser for an air purifier comprising an air intake duct, a receiving electrode and an emitting electrode, where the air intake duct comprises a tapered section, and wherein at least one of the receiving and emitting electrode forms a part of the tapered section, an air purifier comprising such an ioniser and a vehicle comprising such an air purifier.

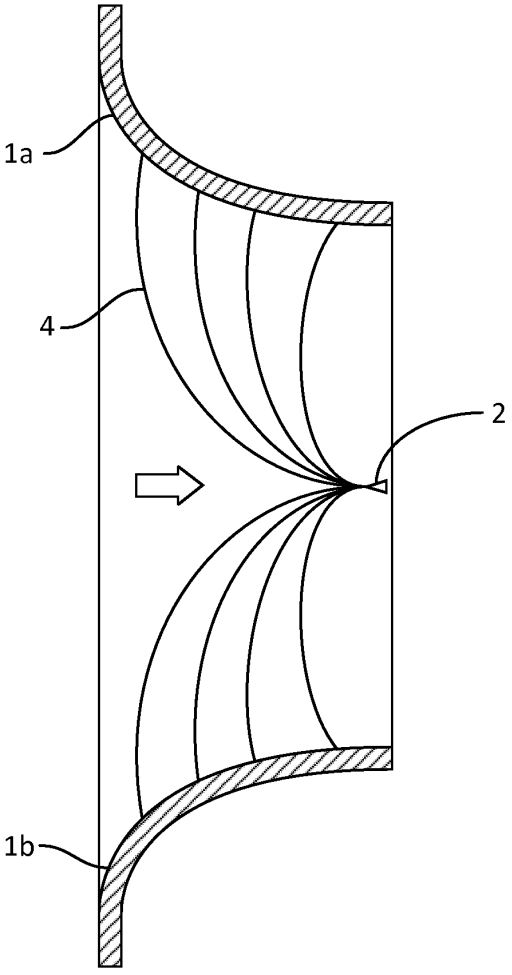

FIG. 2

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Description

[0001] Despite the prior art there remains a need for improved ionisers for air purifiers.

[0002] Accordingly, and in a first aspect, there is provided an ioniser for an air purifier comprising an air intake duct, a receiving electrode and an emitting electrode, where the air intake duct comprises a tapered section, and wherein at least one of the receiving or emitting electrode forms a part of the tapered section.

[0003] We have surprisingly found that the arrangement according to the invention provides optimal ionisation of pollutants in the air stream entering an air purifier. Pollutant particles entering away from the centre of the tapered section of the air intake duct move more slowly and particles towards the centre move more quickly. However, by arranging the ioniser according to the invention we have found that the amount of ionisation the particles are subjected to is substantially similar. This consequentially, results in more efficient capture by the filter in the air purifier.

[0004] The air intake duct is the aperture through which the ambient air passes as it enters the ioniser. The intake duct may comprise any number of intake walls to define an aperture through which the air enters from ambient into the device which treats the air.

[0005] By tapered is meant that the air intake duct becomes narrower in cross section as the air enters the ioniser from ambient air.

[0006] The device comprises an emitting electrode and a receiving electrode. These are standard in the art and refer to electrodes which are capable of generating an ion field when subjected to an appropriate voltage. Typically, the voltage will be in the range of up to +/- 20 kV though this depends on the location of the device. For example, in a vehicle, where electromagnetic interference is to be managed it is typical to find voltages of +/- 7 kV.

[0007] The emitting electrode preferably comprises at least one corona discharge tip which may be a pin, point, brush or suchlike.

[0008] The receiving electrode is configured accordingly to enable generation of an ion field when a voltage is applied to the emitting electrode.

[0009] Preferably, the emitting electrode is disposed substantially along the tapering axis. The tapering axis runs centrally from the exterior of the intake to the interior. Where the tapered section of the intake is in the form of a cone or a frustro-cone, it would be the cone axis. Where the tapered section of the intake duct comprises a pair of opposing surfaces it would be the plane between the two surfaces.

[0010] Preferably, the emitting electrode is located substantially equidistantly between two receiving electrodes, or between two parts of the same electrode where the electrode extends circumferentially around an emitting electrode.

[0011] More preferably, the emitting electrode is located between such receiving electrodes and, along the tapering axis, at a position between tapering parts of the air intake.

[0012] Preferably, the receiving electrode is located within the tapering section of the air intake.

[0013] Preferably, the ioniser for an air purifier comprises an air intake duct in the form of a frustro-cone, a receiving electrode and an emitting electrode and wherein at least one of the receiving or emitting electrode forms a part of the frustro-cone. Preferably, the frustro-cone is in the form of a bell mouth or trumpet and which tapers as ambient air moves from the exterior of the device towards the interior.

[0014] In a preferred embodiment, one of the receiving electrode or the emitting electrode forms part of the frustro-cone. In other words, the receiving or emitting electrode is part of or disposed on or in the frustro-cone.

[0015] Such a design improves the ionisation of the pollutants entering the device.

[0016] Preferably, the air intake duct comprises an air intake wall, a portion of which is the emitting electrode or receiving electrode. In such an embodiment the electrode, whether receiving or emitting, forms part of the air intake duct surface.

[0017] Preferably, the air intake duct presents a frustro-cone when viewed along the central axis, and wherein the air intake wall or walls comprise(s) either a receiving electrode or an emitting electrode. In such an embodiment the air intake wall or walls may present a pair of separate but symmetrically disposed parts. For example, each intake wall may comprise a longitudinal surface curved in relation to the airflow direction between them such that the distance between the walls becomes smaller as the air passes from the exterior to the interior of the device.

[0018] In such an embodiment it is preferred that the emitting electrode is disposed centrally along the central axis and is in the form of a rod or blade. Further, the receiving electrodes will be disposed on the opposing air intake surfaces and may preferably form at least part of the intake surfaces.

[0019] Where the emitting electrode is in the form of a rod or blade it is preferred that it comprises at least one and preferably a plurality of corona discharge tips. These may be pointing towards the receiving electrodes or even pointing equidistantly between them, i.e. directed towards the airflow intake.

[0020] Preferably, such a rod or blade will comprise corona discharge tips in two opposing directions.

[0021] Preferably and where the air intake duct comprises a pair of opposing air intake duct walls, both air intake duct walls comprise a receiving electrode and the emitting electrode is disposed equidistantly between them.

[0022] In an alternative embodiment there is one air intake duct wall and which is radially symmetrical about a cone axis. More preferably, the radius of the cone decreases such that the resulting frustro-cone is trumpet or

bell-mouth shaped. Preferably, the air intake wall or walls is/are substantially circular when cut in a section conforming with the cone base.

[0023] Preferably, the ioniser comprises an emitting electrode or a receiving electrode along the cone axis. In such an embodiment the emitting or receiving electrode is disposed centrally such that the distance between the centrally disposed electrode and the air intake walls is substantially similar when viewed in a section conforming with the cone base. Preferably, the centrally disposed electrode is the emitting electrode and the receiving electrode comprises part of the air intake wall.

[0024] Preferably, the emitting electrode or receiving electrode is disposed on the cone axis and at the closest point to the receiving electrode or receiving electrode accordingly.

[0025] More preferably, the ioniser generates a pair of opposing ion fields. The first is directed towards the ambient air and the second is directed towards the interior of the device.

[0026] In a second aspect there is provided an air purifying system comprising an ioniser as described in the first aspect.

[0027] Such an air purifying system will comprise a housing for the device and at least one ioniser as described above.

[0028] The air purifying system also preferably comprises a filtration means. Typically, such filtration means is a particle filter such as is known in the art. These are consumable and replaceable filters.

[0029] It will be understood that the device according to the second aspect may not necessarily comprises a particulate filter when manufactured or sold but will comprise a means for locating such a particulate filter after the ioniser in the direction of the air stream during use. Particulate filters are known in the art and are manufactured and sold separately from the air purification device. However, they may comprise cooperating means for fixing the filter in the device. The filter is typically fitted such that air must pass through it as it passes through the device from the fan and towards exiting the device. In this way the air is ionised by the ioniser and then passed through the particulate filter.

[0030] Where the term filter is included herein it is understood that the filter may be fitted separately and is not necessarily included with the manufactured product.

[0031] Where the device is for domestic use, the device will also preferably comprise a fan or impeller. Such fans and impellers are known in the art and draw air into the device and through an ioniser before a filter. The fan or impeller may be disposed before or after the ioniser and before or after the particulate filter.

[0032] Where the device is for a motor vehicle, it may not comprise a dedicated fan or impeller but instead may form part of the air purification system in a Heating Vehicle Air Conditioning system (HVAC). Preferably, the air purifying device comprises a pair of opposing ionising systems according to the first aspect. More preferably, these are disposed opposite one another so that ambient air enters the device from two different sides.

[0033] In a third embodiment the invention provides a vehicle comprising such an air purifier.

[0034] Embodiments of the invention shall now be described with reference to the following figures.

[0035] In detail, figure 1 shows a trumpet shaped air intake (3) with walls (1a and 1b) for guiding air towards an ioniser (direction arrow from A to B) and also as receiving electrode. The ionisation filed generated is between the corona discharge tip (2) and the receiving electrodes (forming parts of 1a and 1b).

[0036] Figure 2 shows the design in figure 1 with the ionisation field illustrated (4).

[0037] Figure 3 shows a pair of ionisers, similar to the ones shown in figures 1 and 2, which flank a centrally disposed fan (5) and which is housed in housing 6.

[0038] Figure 4 shows a device according to figures 1, 2 and 3 seen along the cone axis view.

[0039] Shown is the air intake wall (1) for guiding air into the ioniser from ambient and also to act as receiving electrode for the corona discharge emitting electrode, an outer rim (6) which defines the outer edge of the intake wall (1), and the central intake aperture through which is the ambient air is forced towards a filter mechanism.

[0040] Figure 5 shows a pair of opposing air intake walls which are curved in a fashion which narrows the air intake cross section as ambient air enters the ioniser.

[0041] Shown are walls (1a) and (1 b) which function as receiving electrodes and centrally disposed corona discharge pin (2). Air direction from ambient to inside the device is shown by the arrow.

[0042] In figure 6 is shown an alternative design for the corona discharge device. In this figure, the corona discharge device comprises a series of opposing pins (8). In Figure 7 the corona discharge device is a wire (2).

[0043] In figure 7, is shown the same device illustrated in Figure 5 but in perspective.

Claims

1. An ioniser for an air purifier comprising an air intake duct, a receiving electrode and an emitting electrode, where the air intake duct comprises a tapered section, and wherein at least one of the receiving and emitting electrode forms a part of the tapered section.

2. An ioniser for an air purifier according to claim 1 comprising an air intake in the form of a frustro-cone, a receiving electrode and an emitting electrode and wherein at least one of the receiving or emitting electrode forms a part of the frustro-cone.

3. An ioniser according to claim 1 or 2 wherein the receiving electrode forms part of the tapered section of the air intake duct.

4. An ioniser according to claim 1, wherein the air intake duct comprises a pair of air intake duct surfaces opposed about a central axis and which are shaped so as to present a tapered section when viewed along the central axis, and wherein both air intake duct surfaces comprise either a receiving electrode or an emitting electrode.

5. An ioniser according to claim 4 wherein both air intake surfaces comprise a receiving electrode.

6. An ioniser according to any preceding claim comprising an emitting electrode or a receiving electrode along the taper axis.

7. An ioniser according to claim 6 wherein the emitting electrode or receiving electrode is disposed on the taper axis and at the closest point to the receiving electrode or receiving electrode accordingly.

8. An ioniser according to any preceding claim wherein the emitting electrode is in the form of a rod or blade and is disposed along the central axis.

9. An air purifying system comprising an ioniser as claimed in any of claims 1-8 and a filter.

10. An air purifying system as claimed in claim 9 comprising a fan or impeller.

11. A vehicle comprising an air purifier according to claim 10.

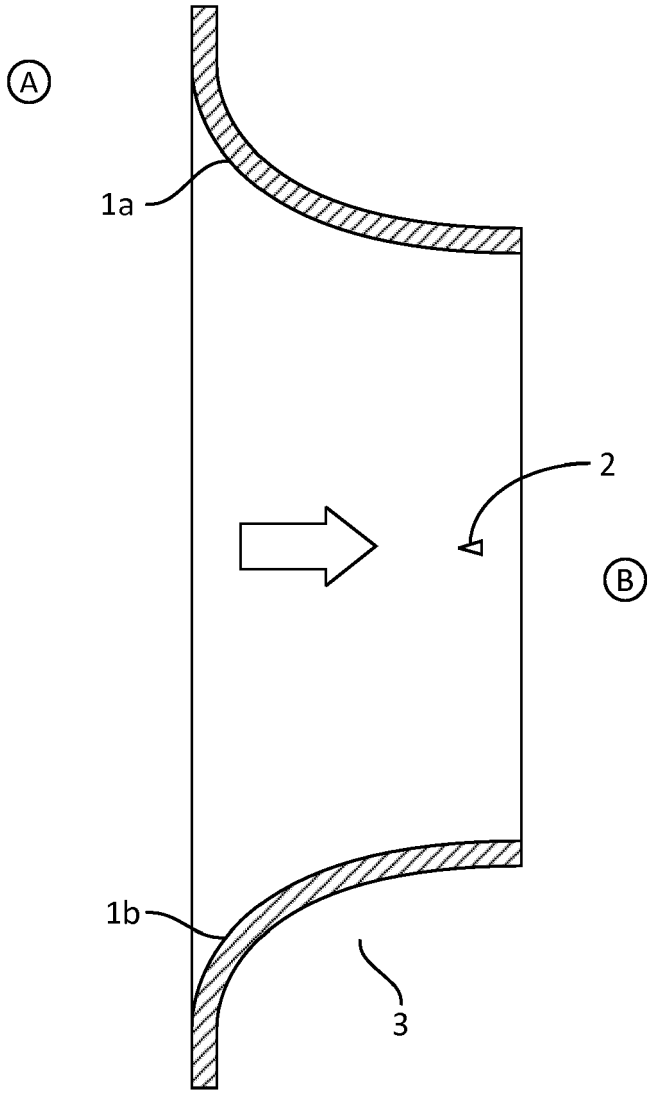

FIG. 1

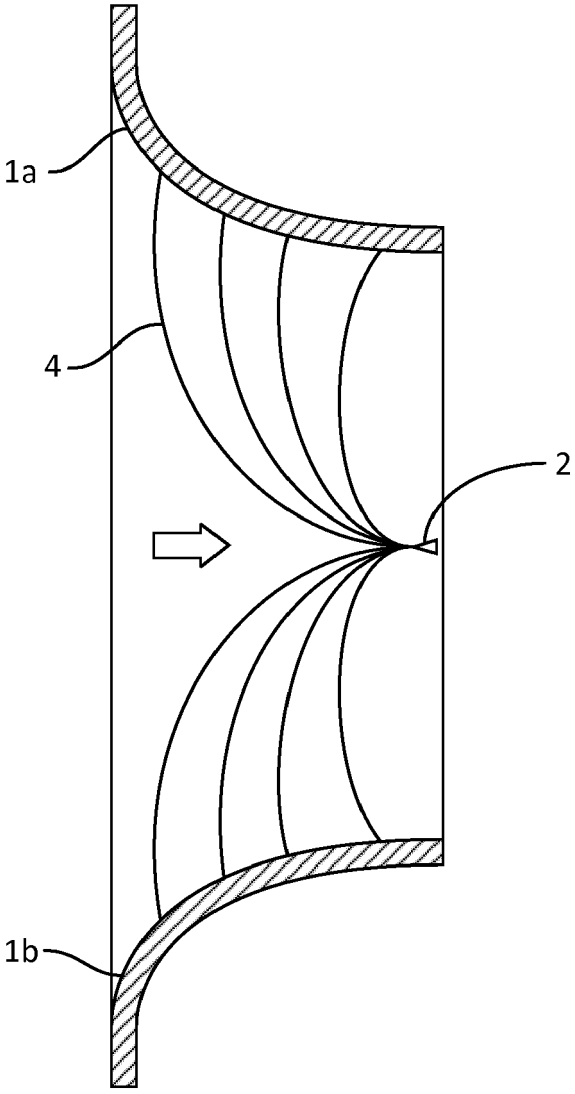

FIG. 2

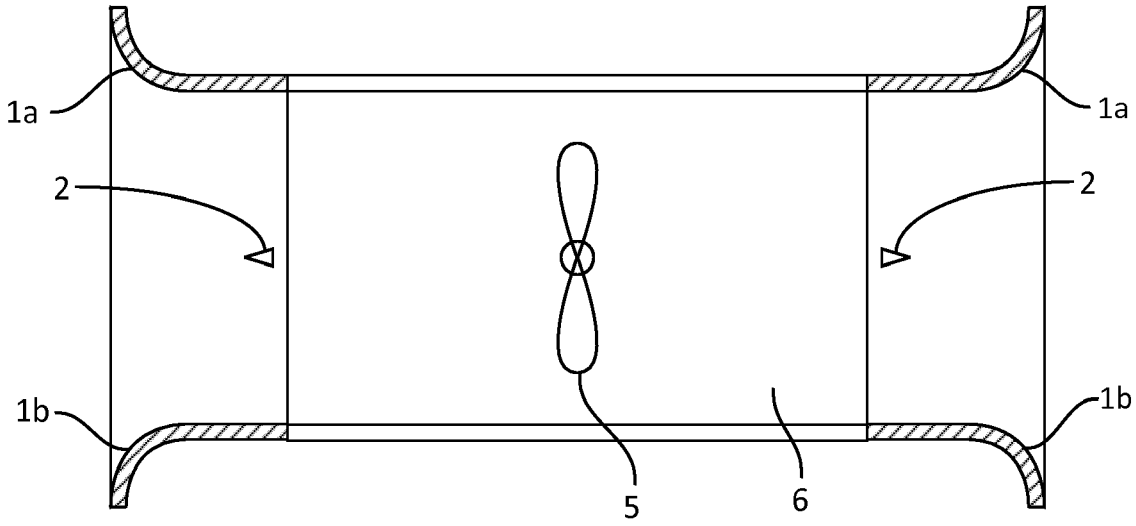

FIG. 3

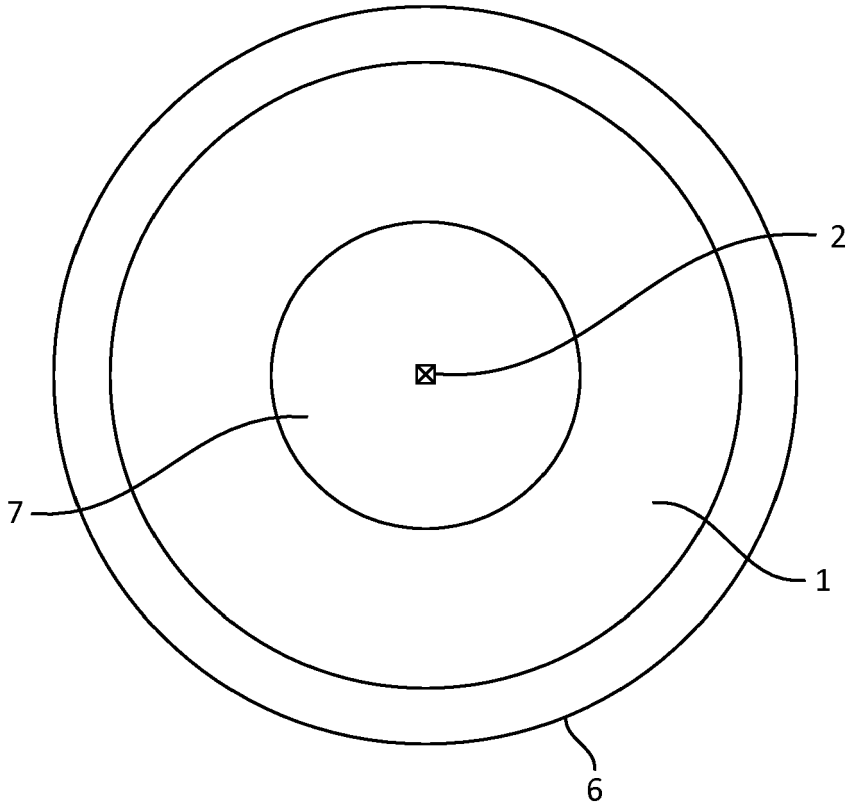

FIG. 4

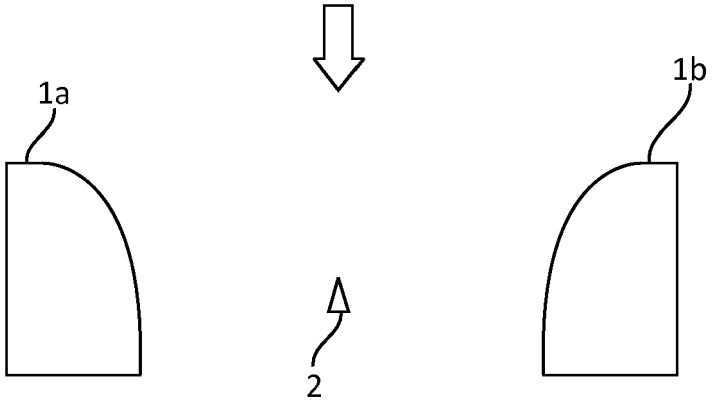

FIG. 5

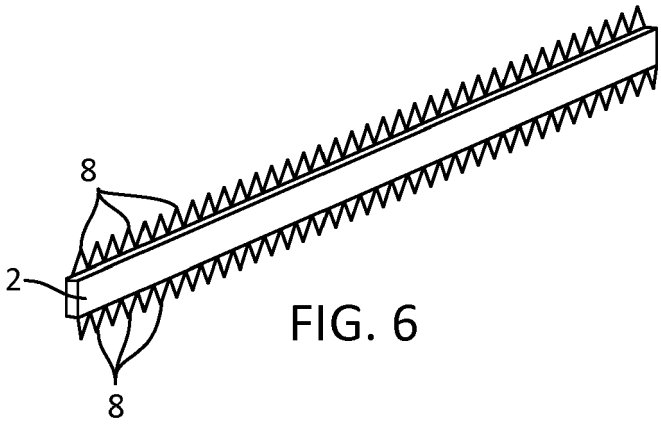

FIG. 6

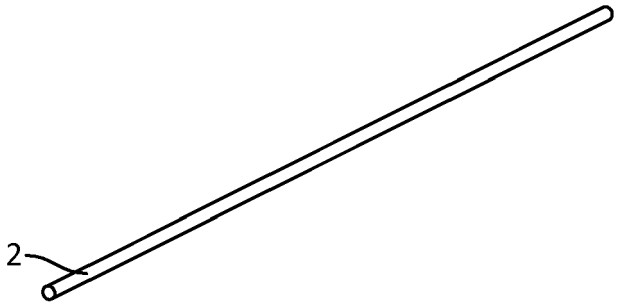

FIG. 7

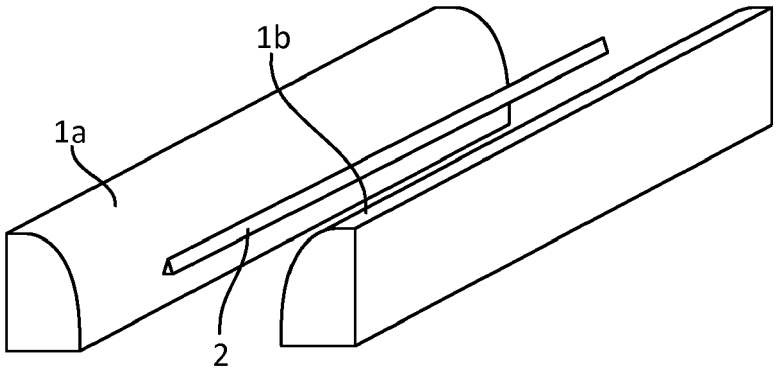

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 3948

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 A	WO 2016/111211 A1 (KATANO KOGYO CO LTD [JP]) 14 July 2016 (2016-07-14) * figures 3,4, F1,F2 *	1-3,6, 9-11 4,5,7,8	INV. H01T19/04 H01T23/00
X A	US 4 247 307 A (CHANG CHING M) 27 January 1981 (1981-01-27) * column 6, line 35 - column 7, line 57; figure 1 *	1-3,6,7, 9-11 4,5,8	
X A	US 2004/191134 A1 (TAYLOR CHARLES E [US] ET AL) 30 September 2004 (2004-09-30) * paragraph [0070] - paragraph [0078]; figures 4E-4K *	1,3-6, 8-11 2,7	
X	WO 2014/102258 A1 (CENTRE NAT RECH SCIENT [FR]) 3 July 2014 (2014-07-03) * claim 3; figures 1,5 *	1-4,6, 8-11	

TECHNICAL FIELDS SEARCHED (IPC)

H01T

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 May 2019	Ernst, Uwe

CATEGORY OF CITED DOCUMENTS

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23-05-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2016111211 A1	14-07-2016	JP 5778360 B1	16-09-2015
		JP 2016123768 A	11-07-2016
		TW 201640063 A	16-11-2016
		WO 2016111211 A1	14-07-2016
US 4247307 A	27-01-1981	NONE	
US 2004191134 A1	30-09-2004	AU 1607900 A	22-05-2000
		CN 1331614 A	16-01-2002
		EP 1135205 A1	26-09-2001
		JP 4799733 B2	26-10-2011
		JP 5356428 B2	04-12-2013
		JP 2002528260 A	03-09-2002
		JP 2011115791 A	16-06-2011
		US RE41812 E	12-10-2010
		US 6176977 B1	23-01-2001
		US 2001004046 A1	21-06-2001
		US 2002079212 A1	27-06-2002
		US 2002098131 A1	25-07-2002
		US 2004096376 A1	20-05-2004
		US 2004191134 A1	30-09-2004
		US 2005232831 A1	20-10-2005
		WO 0025909 A1	11-05-2000
WO 2014102258 A1	03-07-2014	EP 2939317 A1	04-11-2015
		FR 3000414 A1	04-07-2014
		US 2015349501 A1	03-12-2015
		WO 2014102258 A1	03-07-2014

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