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INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2020/050996	22.04.2020	07.05.2019

International Patent Classification (IPC) or both national classification and IPC
INV. G01N27/64 G01N33/00 G01N1/22

Applicant
SENSORHUT LTD

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/GB2020/050996

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-16
	No:	Claims	17
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-17
Industrial applicability (IA)	Yes:	Claims	1-17
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item VIII

Certain observations on the international application

1 **General Remark:** Features following expressions like "*such as*" or "*optionally*" are considered as optional features and have no limiting effect on the scope of a claim (see PCT Guidelines II-5.40).

2 **General Remark:** The usage of multiple "*and/or*" or "*or*" combinations/ alternatives within the claims render the respective claims difficult to construe and should have thus been avoided (see PCT Guidelines II-5.18).

3 **General Remark:** It is the applicant's responsibility to ensure that registered trademarks are acknowledged as such in the description.

4 **Claim 17** is interpreted as a method claim. The claim does not contain any method steps describing the use of the *microporous and/or mesoporous dielectric or semiconducting material as adsorbent in a detector* and is therefore objected on the grounds of lack of clarity and the absence of technical features (see PCT Guidelines II-A5.21 and Rule 6.3 PCT).

5 The vague and imprecise statement in the description on p. 44, l. 23-34 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 **Cited documents**

Reference is made to the following documents:

D1 US 2019/025271 A1

D2 US 2007/077176 A1

D3 US 2009/317916 A1

D4 WO 2015/151537 A1 *

D5 US 2008/184886 A1

D6 US 2016/146765 A1

D7 US 2015/168330 A1

D8 US 2016/096793 A1

D9 WO 2019/031260 A1 *

D10 US 2016/018373 A1

* For the purpose of the present examination legally non-binding machine translations were used to interpret the content of the Asian prior art. The cited passages relate to the translations, which are attached to this communication.

2 **Independent claim 17**

The broadest claimed subject-matter is defined in independent claim 17, which is therefore treated first.

Applicant's attention is drawn to the fact that below citations are provided as selected examples and other relevant disclosures were encountered during search.

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 17 is not new in the sense of Article 33(2) PCT.

D1 (Fig. 1 with [0014]-[0018]) discloses:

> Use of microporous and/or mesoporous dielectric or semiconducting material such as a silica, a zeolite, activated carbon and/or a metal organic framework, MOF (Fig. 1 (140), "adsorbent layer" with [0018], "mesoporous silica, silica gel, activated silica, zeolite, metal organic framework or other suitable material") as an adsorbent for an analyte in a detector (Fig. 1 (100), "miniature gas sensing device" and (140), "adsorbent layer").

Moreover, also the following documents anticipate the subject-matter of claim 17:

D2 (Fig. 1 with [0033]-[0038]): microporous and/or mesoporous dielectric or semiconducting material (Fig. 1 (114), "adsorber" with [0034], "activated carbon [...] zeolite", both being intrinsically porous) as

adsorbent for an analyte in a detector (Fig. 1 (100), "chemical sensor" and (114), "adsorber" with]0034], "adsorbs ethanol vapor").

D3 (Fig. 5, 6A with [0034], [0035], [0042], [0048], [0049]): microporous and/or mesoporous dielectric or semiconducting material ([0034], [0035]) as adsorbent for an analyte in a detector (Fig. 5 (10), "collection device" with [0048], "sorbent material 12 of the collection device 10" and (20), "detection device" with [0049]).

D4 (Fig. 1 with p. 3, §5-p. 8, §5): microporous and/or mesoporous dielectric or semiconducting material (Fig. 1 (30), "adsorbent" with p. 4, §3, "adsorbs the component gas contained in the gas [...] zeolite [....] activated carbon, silica [...]") as adsorbent for an analyte in a detector (Fig. 1 (100) "gas detection device" and (30), "adsorption material" with p. 4,§7-p.5, §1).

D5 (Fig. 9 (60), "sorbent A" and (62), "sorbent B" with [0132] with [0004], [0106]).

D7 ([0045], [0048] as well as Fig. 1 (100), "sensor element" and (135), "sorbent material").

D9 (Fig. 1 (1), "gas sensor" with Fig. 2 (2), "thermal resistance element" and (3), "gas molecule adsorbing material" with [0042]).

3 Independent claim 1

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

D5 (Fig. 1-12 with [0004]-[0149]) discloses:

> A detector for detecting analytes in gas-phase ([0004], "systems [...] for sensing and identifying chemical compounds" with [0013], "gas including a chemical species"), comprising:
> a first sorbent of a set of sorbents (Fig. 9 (60), "sorbent A" and (62), "sorbent B" with [0132]), wherein the first sorbent comprises and/or is a microporous and/or mesoporous dielectric or semiconducting material such as silica or silicon, a zeolite, activated carbon and/or a metal organic framework, MOF ([0106], "activated carbon [...] zeolite"

which are both intrinsically porous), for sorbing therein and/or thereon and/or desorbing therefrom, a first analyte of a set of analytes included in a first gas of a set of gases exposed thereto, at a zeroth temperature, pressure (To, P_o) (see [0111], "sorbent material [...] sorption of the chemical species from for example a gas supply"), of a set of temperatures, pressures (T, P), wherein the first gas is ambient air ([0097], "gas being sampled is [...] room air that is suspected of being contaminated with the analyte");

a cooler arranged to cool the first sorbent to the zeroth temperature (T_o) ([0084], "thermoelectric coolers [...] cools and then heats the sorbent material" as well as Fig. 4 (400) with [0111], "sorbent material can be cooled below room temperature to facilitate sorption of the chemical species");

~~a controller arranged to~~ change the zeroth temperature, pressure (To, P_o) to a first temperature, pressure (T_1, P_1) of the set of temperatures, pressures (T,P) according to a first equation of a set of equations, to desorb and/or sorb at least some of the first analyte (Fig. 4 (404) with [0111], "sorbent material can be heated to a desorption temperature at which the chemical species desorbs" which implies applying a heating profile); and

a sensor arranged to sense at least some of the first analyte and to output a first response of a set of responses corresponding to the sensed first analyte, wherein the sensor comprises and/or is a broadband analyte detector such as a photoionization detector, PID (Fig. 10 (78), "detector" as well as Fig. 4 (406) with [0114], "chemical species can be detected [...] by one of suitable detectors [...]");

~~wherein the detector [...]; and~~

wherein the first response comprises and/or is a first characteristic response of a set of characteristic responses of the first analyte (implied by Fig. 4 (406) as well as [0114]).

The subject-matter of claim 1 differs thus from this known detector in that:

a.) the measurement process is controlled by a controller

b.) the detector is arranged to obtain a first baseline response of a set of baseline responses at the zeroth temperature, pressure (To, P_o) and wherein the controller is arranged to modify the first response based, at least in part, on the obtained first baseline response.

Distinguishing feature a.): Automating a measurement process by using a controller (see for example **D3** (Fig. 5 (30), "control device" with [0067], [0068])) is standard within the field and does not allow to justify an inventive character of the subject-matter of claim 1.

Distinguishing feature b.): Recording a baseline signal in the presence of zero analyte (all of the analyte being adsorbed in/on the cooled sorbent material) and further correcting the measurement signal obtained in the presence of the analyte (sorbent material heated in order to desorb analyte) to reduce effects caused by drift of the sensor signal, changes in temperature etc. and thus to improve the accuracy of the detection of extremely low concentrations of the target analyte is a standard technique within the field of chemical (gas) sensing (see for example **D6** ([0067], "the chemical detectors of the detector 120 generate a signal that is read substantially continuously. In such a manner, the baseline of the chemical detectors may be reset according to changes in the atmosphere, the ambient temperature, the atmospheric pressure, and/or a wear and/or a deformation of the chemical detector") or **D7** ([0065], "a reference zero concentration (i.e., reference baseline) to ensure accuracy [...] reference baseline is subtracted to give a corrected capacitance")) and can be considered as being part of the routine work of the skilled person for which he does not require inventive skill.

The subject-matter of claim 1 of the present application can therefore not be considered to involve an inventive step (Article 33(3) PCT).

4 Independent claim 10

Independent method claim 10 corresponds in terms of method features to device claim 1. Therefore, the same reasoning as presented above applies, mutatis mutandis, to method claim 10.

The subject-matter of claim 10 is therefore not inventive in view of **D5** (Article 33(1) and 33(3) PCT).

5 **Dependent claims**

Dependent claim 2-9 and 11-16 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, the reasons being as follows:

Claims 2, 11: obvious in view of **D5.** Comparing measurement data (including pattern matching methods) to predetermined reference data is standard within the field, see for example **D9** ([0074], "In addition, in order to detect a specific gas, the output of the reference gas is measured in advance. Further, in the detection step, the concentration of a specific gas is detected by comparing the measurement result of the output of the reference gas with the measurement result of the specific gas output in advance").

Claims 3, 12: obvious in view of **D5** (Fig. 4 (404) with [0111]).

Claims 4, 13: obvious in view of **D5.** Changing the pressure is a standard alternative way (not coming along with any surprising/unexpected technical effect. no such effect indicated in the present application) of initiating desorption of analyte molecules, see for example **D8** ([0084], "regenerate the adsorbent. Increasing the temperature and/or decreasing the pressure reduce the amount of time required for desorption, while decreasing the temperature and/or increasing the pressure would increase the amount of time required for desorption").

Claims 5, 6: obvious in view of **D5** ([0084], "thermoelectric coolers [...] cools and then heats the sorbent material" as well as Fig. 3 (30, 31, 32), "thermoelectric unit" and (50, 51), "sorbent materials").

Claims 7, 14: obvious in view of **D5. D7** ([0065], "sensor element should be calibrated using known concentrations of an analyte vapor to be measured (thereby generating calibration data)"), suggests an initial calibration of the sensor, which is standard within the field, and which would comprise running an initial temperature changing profile. Moreover, also initial test-runs to set the optimum operating point of the sensor are standard within the field, see for example **D10** ([0090]).

Claims 8, 15: obvious in view of **D5**. Standard implementation in order to control gas flow across sorbent material (see **D5** ([0112, "gas including the chemical species can flow across the sorbent material")), see for example **D3** (Fig. 5 with [0048], "sample collection device 40 may contain a pump or a fan to move air through the sorbent material 12 in the sample collection device 10").

Claims 9, 16: obvious in view of **D5**. Suggested by paragraph [0109], "For example, components A and C are both sorbed by material A1, but component A desorbs at a lower temperature than C. The desorption process can then include two steps, one at a low temperature to desorb A then one at a high temperature to desorb C".

Re Item VII

Certain defects in the international application

1 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in **D1-D9** is not mentioned in the description, nor are these documents identified therein.