PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

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/US2022/040366	15.08.2022	13.08.2021

International Patent Classification (IPC) or both national classification and IPC
INV. F01N3/20 F01N13/00 F01N3/08

Applicant
ECC TEC MSJ INCORPORATED

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
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Seifert, Marco Telephone No. +49 89 2399-0

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.

   b. ☐ furnished subsequent to the international filing date for the purposes of international search (Rule 13*ter*.1(a)),

      ☐ accompanied by a statement to the effect that the sequence listing does not go beyond the disclosure in the international application as filed.

4. ☐ With regard to any nucleotide and/or amino acid sequence disclosed in the international application, this opinion has been established to the extent that a meaningful opinion could be formed without a WIPO Standard ST.26 compliant sequence listing.

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	1-25
	No:	Claims	26-38
Inventive step (IS)	Yes:	Claims	1-25
	No:	Claims	26-38
Industrial applicability (IA)	Yes:	Claims	1-38
	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 V

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

Reference is made to the following documents:

D1 US 2017/226909 A1 (HIRTH PETER [DE] ET AL) 10 August 2017 (2017-08-10)

D2 US 2013/061576 A1 (GONZE EUGENE V [US] ET AL) 14 March 2013 (2013-03-14)

1 **Independent claim 1**

Document D1 (figure 1, claim 1) is regarded as being the prior art closest to the subject-matter of claim 1, and discloses

a heater (figure 1) for an exhaust system, comprising:
a housing including **a connector coupled to the exterior of the housing**, anda **first terminal and a second terminal (15)**, each disposed to the interior of the housing and **electrically coupled to the connector**;
a heating element (3) coupled to the first and second terminals;

The subject-matter of claim 1 therefore differs from this known in that

a heating wire coupled to the first and second terminals; and
a plurality of heating rods inserted through openings in the heating element **to conduct heat from the heating wire** throughout the heating element, at least one of the heating rods to support the heating wire,
wherein **the connector (paragraph 0015, 0018)** is configured to receive power from a power supply that is external from the heater to supply electrical current to the heating element and the heating wire.

and is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as how to optimise the heating up of an exhaust treatment system.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

The idea of the invention is to improve heating both a heating wire and a heating element with are thermally coupled by a heating rod in order to improve heating of an exhaust treamtment system. It is pointed out that is a rather complex and cost intensive approach. Starting from D1 the person skilled in the art has various possibilities to improve heating (e.g. increase electrical power, imcreas heat exchange surface). However, there is nothing in D1 nor the known prior art which would lead the person skilled in the art to the missing features of independent claim 1.

2 **Independent claim 26**

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 26 is not new in the sense of Article 33(2) PCT.

Document D1 (figure 1, claim 1) is regarded as being the prior art closest to the subject-matter of claim 26, and discloses all clear featues of claim 26:

a structure (figure 1-4) comprising:
an exhaust pipe (figure 4) configured to be coupled to an exhaust system component, the exhaust pipe comprising:
a heater (figure 1) disposed inside a cavity of the exhaust pipe, the heater comprising:
a housing,
a heating wire (3) disposed inside the housing, and
a connector (paragraph 0015, 0018) attached to the housing and electrically connected to the heating wire, the connector configured to receive power from a power supply that is external from the heater to supply electrical current to the heating wire, wherein the heater is configured to heat gas inside the exhaust pipe

3 **Independent claim 30**

Furthermore, the above-mentioned lack of clarity notwithstanding, the subject-matter of claim 30 is not new in the sense of Article 33(2) PCT, and the criteria of Article 33(1) PCT are therefore not met.

Document D2 discloses all clear features of claim 1:

a structure comprising a heater (figure 1) configured to be connected external to a component of a vehicle exhaust system, the heater comprising:
a housing,
a heating element (figure 1, element 22), and
a sensor (figure 1, element 52)

4 **Dependent claims 2-25**

Claims 2-25 are dependent on one or more independent claims whose subject-matter is considered as being new and inventive, as discussed above, and as such said dependent claims also meet the requirements of the PCT with respect to novelty and inventive step.

5 **Dependent claim 27**

Dependent claims 27 does not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and inventive step.

Document D1 shows a catalytic converter (see figure 1).

6 **Dependent claims 28-29**

Dependent claims 28-29 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and inventive step. They claims do not add any clear features (see clarity).

7 **Dependent claim 31-38**

Dependent claims 31-38 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and inventive step:

dependent claim 31-34: D2 shows an SCR system (figure 1)

dependent claim 35 - 38: D2 shows an exhaust pipe temperature sensor and an exhaust gas sensor (element 62, element 50)

Re Item VII

Certain defects in the international application

The features of claims 1-38 are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Re Item VIII

Certain observations on the international application

8 **Independent claim 1**

The application does not meet the requirements of Article 6 PCT, because claim 1 is not clear.

The claim appears to address the embodiment shown in figure 19 (see below) and the corresponding parts in the description (paragraph 0163-0170):

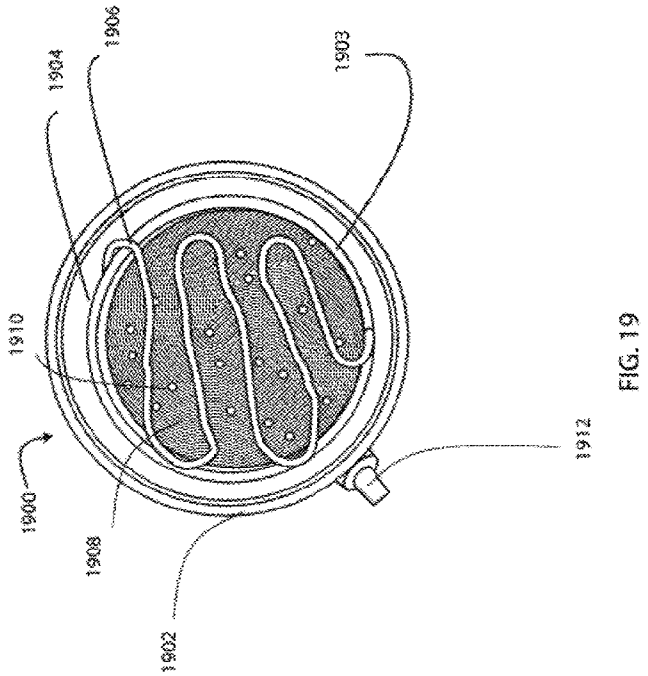

FIG. 19

"[0163] FIG. 19 illustrates a heater 1902 according to an embodiment of the present disclosure. The heater 1902 **may** include a housing 1902, **a first terminal** 1903, **a second terminal** 1904, **one or more heating wires** 1906 (although only one is shown, multiple levels of the heating wires, similar to the heating wires 1804 shown in FIG. 18A, may be utilized), **a heating element 1908**, **a plurality of heating rods 1910, and a connector 1912**. The housing 1902 may be a metallic housing.

[0164] **The first terminal 1903 may be a positive (or negative) terminal, and the second terminal 1904 may be a negative (or positive) terminal or ground**. **In one embodiment, the first terminal 1903 may be electrically coupled to the connector 1912, and the second terminal 1904 may be electrically coupled to the housing 1902.**

[0165] **The heating wire** 1906 **may** be **electrically coupled** between t**he first terminal** 1903 and the **second terminal** 1904. In this embodiment, **the connecto**r 1912 **may** be configured **to receive electric current from a power supply and may function as a positive (or negative) terminal**. Further, the housing 1902 **may be configured to function as a negative (or positive) terminal or ground.** Accordingly, an electrical potential supplied by the power supply between the positive terminal 1903 (e.g., via the connector 1912) and the negative terminal 1904 (e.g., via the housing 1902) may induce electric current between the first terminal 1903 and the second terminal 1904. Accordingly, the heating wire 1906 coupled between the first terminal 1903 and the second terminal 1904 may heat up based on the level of supplied current.Additionally, **the heating element** 1908, which may include a **metallic material, may** be **electrically coupled to the first and/or second terminals** 1903, 1904,and may also heat up as a result of the current being supplied".

Paragraph 0164-0165 address the electric supply of the heater and the heating element. In paragraph 0164 it is stated that the first connector may be electrically coupled to the connector, and the second terminal may be electrically coupled to the housing. According to independent claim 1 both terminals are coupled to the connector. This inconsistency between the claims and the description leads to doubt concerning the matter for which protection is sought, thereby rendering the claims unclear, Article 6 PCT.

In Paragaraph 0170 of the description the setup of the heating rods is discussed:

"[0170] FIG. 21 illustrates one exemplary heating rod 2016 according to an embodiment of the present disclosure. The heating rod 2016 **may include a rod portion 2106 made of metal** (e.g., a heat-treated metal or alloy (e.g., copper or steel)) and a **tip portion 2104** made of an aluminum alloy having an **insulative property**. Accordingly, the tip portion 2104 **may prevent passage of current through the heating rod 2016, so as to prevent any shorting or overheating of the heating rod** 2016."

It is understood that the tip portion prevents a shorting of the heating rod. Therefore the system of independent claim 1 does not work without this feature. Since independent claim 1 does not contain these features it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

Claim 1does not meet the requirements of Article 6 PCT because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result. Claim 1 states that the heating rods conduct heat from the heating wire throughout the heating element without stating how this is achieved.

Independent claim 1 should be adapted as follows: " the heating rod **includes a rod portion made of metal** and a **tip portion** made of an aluminum alloy having an **insulative property**. The tip portion **prevents passage of current through the heating rod, so as to prevent any shorting or overheating of the heating rod"**

9 **Dependent claims 20-22**

The application does not meet the requirements of Article 6 PCT, because claim 20-22 are not clear.

What concerns the features "**magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component" it is not clear how the effect of "disruption and slowing of the exhaust gases in the component" is achieved. For further reasoning see independent claim 30.**

10 **Independent claim 26**

The application does not meet the requirements of Article 6 PCT, because claim 26 is not clear.

Claim 26 does not meet the requirements of Article 6 PCT because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

It is clear that the heater is configured to heat exhaust gas.

However, it is absolutely clear that the structure with the heat cannot "reduce toxic gases and/or particulate matter exiting the exhaust pipe", since no cleaning device is part of the structure defined in claim 26.

11 **Dependent claim 28-29**

What concerns the features "**magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component" it is not clear how the effect of "disruption and slowing of the exhaust gases in the component" is achieved. For further reasoning see independent claim 30.**

12 **Independent claim 30**

The application does not meet the requirements of Article 6 PCT, because claim 30 is not clear.

The claim addresses "a structure" comprising a heater wherein the heater comprises a housing, a heating element, a sensor and a magnet. Furthermore it is stated that the **magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component.**

When studying the application (description and figures) it is clear that claim 30 addresses a vehicle exhaust system and not just a structure.

What concerns the features "**magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component" it is not clear how the effect of "disruption and slowing of the exhaust gases in the component" is achieved.**

Note that independent claim 30 simply states that the structure comprises a heater and that a magnet is arranged adjacent to an exteriour surface of the component. Although it is stated that the sturcture comprises a heater it is not specified how the magnet and the heater are related to each other.

It appears from the figures that heater and magnets have to set up in certain way. This appears to be essential for the invention.

Since independent claim 30 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

In this context it is absolutely not clear what physical effect the magnets use to aid in disruption and slowing of the flow of exhaust gases.

Claim 30 does not meet the requirements of Article 6 PCT because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

Following this discussion the clear features of claim 1 are considered as follows:

"a heater configured to be connected external to a component of a vehicle exhaust system, the heater comprising:
a housing,
a heating element, and
a sensor"

Only this features will be addressed with respect to novelty.

13 **Independent claim 30**

The application does not meet the requirements of Article 6 PCT, because claim 30 is not clear.

The claim addresses "a structure" comprising a heater wherein the heater comprises a housing, a heating element, a sensor and a magnet. Furthermore it is stated that the **magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component.**

When studying the application (description and figures) it is clear that claim 30 addresses a vehicle exhaust system and not just a structure.

What concerns the features "**magnet is configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component" it is not clear how the effect of "disruption and slowing of the exhaust gases in the component" is achieved.**

Note that independent claim 30 simply states that the structure comprises a heater and that a magnet is arranged adjacent to an exteriour surface of the component. Although it is stated that the sturcture comprises a heater it is not specified how the magnet and the heater are related to each other.

It appears from the figures that heater and magnets have to set up in certain way. This appears to be essential for the invention.

Since independent claim 30 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

In this context it is absolutely not clear what physical effect the magnets use to aid in disruption and slowing of the flow of exhaust gases.

Claim 30 does not meet the requirements of Article 6 PCT because the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the result to be achieved, which merely amounts to a statement of the underlying problem, without providing the technical features necessary for achieving this result.

Following this discussion the clear features of claim 1 are considered as follows:

"a heater configured to be connected external to a component of a vehicle exhaust system, the heater comprising:
a housing,
a heating element, and
a sensor"

Only this features will be addressed with respect to novelty.

14 Further comments

The vague statement in the description (paragraph 0001) 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.

Independent claim

A structure comprising:
a heater configured to be connected external to a component of a vehicle exhaust system, the heater comprising:
a housing,
a heating element, and
a sensor; and
a magnet configured to be arranged adjacent to an exterior surface of the component to aid in disruption and slowing of the flow of exhaust gases in the component.