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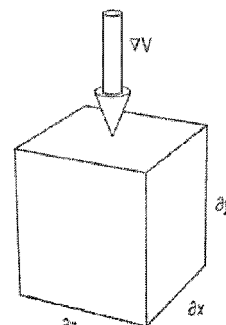
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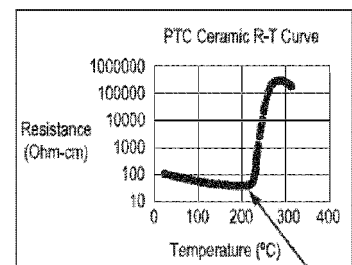
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(54) **VAPORIZER INCLUDING POSITIVE TEMPERATURE COEFFICIENT OF RESISTIVITY HEATER**

(57) A vaporizer device includes a housing including an air inlet, a heating element within the housing and a heat exchanger. The heating element includes a non-linear positive temperature coefficient of resistance material. The heat exchanger is thermally coupled to the heating element and arranged to receive airflow from the air inlet. The heat exchanger is configured to transfer heat between the heating element and the airflow to produce a heated airflow. The heated airflow exiting the heat exchanger is configured to vaporize a vaporizable material. Related apparatus, systems, techniques and articles are also described.



$$P = \int_{vol} \frac{(\nabla V)^2}{\rho} dvol$$



Every control volume $\delta x, \delta y, \delta z$ within an isotropic PTCR material subject to a voltage gradient will heat to a temperature within the PTCR transition zone and hold that temperature over a wide range of ∇V .

FIG. 1



EUROPEAN SEARCH REPORT

Application Number

EP 25 15 7500

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EPO FORM 1503 03.82 (P04C01)

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 April 2025	Examiner Espla, Alexandre
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			



Application Number

EP 25 15 7500

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 25 15 7500

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-15

A vaporizer device comprising a housing, a heating element including a nonlinear PTCR material, a heat exchanger configured to transfer heat between the heating element and an airflow for vaporizing a vaporizable material.

1.1. claims: 1-14

A vaporizer device comprising a housing, a heating element including a nonlinear PTCR material, a heat exchanger configured to transfer heat between the heating element and an airflow for vaporizing a vaporizable material, wherein the nonlinear PTCR material includes an electrical resistivity transition zone in which the electrical resistivity increases steeply and wherein the heat exchanger is made from a metal foam.

1.2. claim: 15

A vaporizer device comprising a housing, a heating element including a nonlinear PTCR material, a heat exchanger configured to transfer heat between the heating element and an airflow for vaporizing a vaporizable material, and a product cover containing the vaporizable material, wherein the product cover includes a cartridge having a first air inlet and a wick in fluidic communication with the vaporizable material, the cartridge is configured to receive the heated airflow through the first air inlet and direct the heated airflow over the wick.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

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

EP 25 15 7500

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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
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EPO FORM P0459

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