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Case Number: T 2065/21 - 3.2.02

Application Number: 15749864.3

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Language of the proceedings: EN

Title of invention:
ELECTRONIC AEROSOL PROVISION SYSTEM

Patent Proprietor:
Nicoventures Trading Limited

Opponents:
JT International S.A.
Philip Morris Products S.A.

Headword:

Relevant legal provisions:
EPC Art. 54(2), 56, 83, 100(c)

Keyword:

Decisions cited:

Catchword:

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Case Number: T 2065/21 - 3.2.02

D E C I S I O N
of Technical Board of Appeal 3.2.02
of 6 May 2024

Appellant: (Patent Proprietor)	Nicoventures Trading Limited Globe House 1 Water Street London WC2R 3LA (GB)
Representative:	D Young & Co LLP 3 Noble Street London EC2V 7BQ (GB)
Party as of right: (Opponent 1)	JT International S.A. 8 rue Kazem Radjavi 1202 Geneva (CH)
Representative:	Gill Jennings & Every LLP The Broadgate Tower 20 Primrose Street London EC2A 2ES (GB)
Appellant: (Opponent 2)	Philip Morris Products S.A. Quai Jeanrenaud 3 2000 Neuchâtel (CH)
Representative:	HGF HGF Limited 1 City Walk Leeds LS11 9DX (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 30 September 2021 concerning maintenance of the European Patent No. 3185941 in amended form.**

Composition of the Board:

Chairman	M. Alvazzi Delfrate
Members:	A. Martinez Möller
	Y. Podbielski

Summary of Facts and Submissions

I. Appeals were filed by the patent proprietor (Nicoventures Trading Limited) and by the opponent 2 (Philip Morris Products S.A.) against the interlocutory decision of the Opposition Division finding that the fifth auxiliary request filed on 29 November 2019 met the requirements of the EPC.

II. Oral proceedings before the Board took place on 6 May 2024.

At the end of the oral proceedings the requests were as follows:

The appellant/proprietor ("proprietor") requested that the decision under appeal be set aside and that the patent be maintained as granted. As an auxiliary measure they requested that the appeal of opponent 2 be dismissed.

The appellant/opponent 2 ("opponent 2") requested that the patent be revoked.

The party as of right/opponent 1 ("opponent 1") requested that the proprietor's appeal be dismissed.

III. Claims 1 and 15 of the **main request** read as follows:

1. "An electronic aerosol provision system (10) comprising:
a heating element (365) for generating an aerosol from a source liquid (360); and
control circuitry (355) for controlling a supply of electrical power from a power supply (210) to the

heating element, and wherein the control circuitry is further configured to:
determine an indication of a derivative of an electrical characteristic of the heating element with respect to time; and
determine whether or not a fault condition for the electronic aerosol provision system has arisen based on the determined indication of the derivative of the electrical characteristic of the heating element with respect to time."

15. "A method of operating an electronic aerosol provision system (10) comprising a heating element (365) for generating an aerosol from a source liquid (360) and control circuitry (355) for controlling a supply of electrical power from a power supply to the heating element, wherein the method comprises:
determining an indication of a derivative of an electrical characteristic of the heating element with respect to time; and determining whether or not a fault condition for the electronic aerosol provision system has arisen based on the determined indication of the derivative of the electrical characteristic of the heating element with respect to time."

IV. Compared with claim 1 of the main request, claim 1 of the **fifth auxiliary request**- which is the version found to be allowable by the appealed decision - further includes the following features added to the end of the claim:

", wherein the control circuitry is configured to determine the indication of the derivative of the electrical characteristic of the heating element with respect to time during a period in which the

temperature of the heating element is considered to be temporally steady."

Claim 10 of the main request was deleted in the fifth auxiliary request.

Claim 14 of the fifth auxiliary request includes the following amendments with regard to claim 15 of the main request:

"determining an indication of a derivative of an electrical characteristic of the heating element with respect to time during a period in which the temperature of the heating element is considered to be temporally steady; and"

V. The following documents are relevant to the present decision:

D3 WO 2012/085203 A1
D5 Fundamental Numerical Methods for Electrical Engineering, S. Rosloniec, Springer-Verlag Berlin Heidelberg, pp. 155

VI. The opponents' arguments relevant to the present decision can be summarised as follows.

Main request - Novelty

The subject-matter of claim 1 was not novel over D3.

D3 disclosed in connection with Figure 3 determining whether the liquid storage portion was empty or nearly empty based on the rate of temperature rise at the onset of a puff, thus anticipating the determination of a fault condition.

The specification of the contested patent did not define what a fault condition was, but it taught that when the liquid reservoir was becoming empty, an unstable liquid supply would occur and cause rapid heating, which was given as an example of a fault condition (paragraphs [0004] and [0021]). In any event, overheating and thus a fault condition must occur in D3 in order to determine that the liquid storage portion is empty or nearly empty.

Fifth auxiliary request - Sufficiency of disclosure

The invention was not sufficiently disclosed because the contested patent neither defined the term "temporally steady" nor explained how to configure the control circuitry to know when such temporal steadiness was achieved.

Fifth auxiliary request - Novelty

The subject-matter of each of claims 1 and 14 was not novel over D3.

D3 disclosed in connection with Figure 2 determining the temperature by determining the resistance after 0.4 seconds. The resistance of the heating element was an indication of the current through the heating element, current was a derivative of charge, and charge was an electrical characteristic of the heating element. Therefore, the determination of the resistance after 0.4 seconds anticipated the feature added to each of claims 1 and 14.

Fifth auxiliary request - Inventive step

The subject-matter of each of claims 1 and 14 was not inventive in view of D3 combined with common general knowledge.

Figure 2 of D3 showed that the temperature could be considered steady after 0.4 seconds of the puff. Use of derivatives to more accurately determine changes in a parameter was part of common general knowledge as shown in textbook D5. Accordingly, starting with the measurement shown in Figure 2 of D3, the person skilled in the art would use the derivative of the temperature at 0.4 seconds of the puff and arrive at the subject-matter of each of claims 1 and 14.

Alternatively, D3 disclosed on page 15, lines 10 to 13 that the rate of temperature increase could provide additional means to detect an amount of liquid. The person skilled in the art using both the temperature and the rate of temperature rise, i.e. combining the measurements of Figures 2 and 3 of D3, would look at the derivative after 0.5 seconds of the puff and thus determine the derivate during a period in which the temperature was considered to be temporally steady.

VII. The proprietor's arguments relevant to the present decision can be summarised as follows.

Main request - Novelty

The subject-matter of claim 1 was novel over D3.

A "fault condition" was something unexpected that happened when a system did not work as expected and was broken.

D3 was concerned with preventing the wick from going dry (condition shown as puff X2 in Figure 3 of D3) by estimating the amount of liquid remaining in the liquid storage portion, determining when that amount fell to a threshold level and switching off the heater before the wick was dry. D3 did not disclose determining that an insufficient supply of liquid to the wick occurred. Instead, it prevented the problem of insufficient liquid supply from occurring and therefore prevented a fault condition from occurring. A low amount of remaining liquid was not a fault condition in a system designed to consume liquid.

Fifth auxiliary request - Sufficiency of disclosure

The person skilled in the art understood that "temporally steady" meant steady with respect to time. It was apparent from paragraph [0050] of the contested patent that claim 1 referred to a period in which the temperature of the heating element was expected to remain in a steady state. Therefore, the invention as defined in the independent claims was sufficiently disclosed.

Fifth auxiliary request - Novelty

The subject-matter of each of claims 1 and 14 was novel over D3.

Charge was not an electrical characteristic of a heating element because it did not depend on any properties of the heating element. It was the flow of charge, i.e. the current, that was a characteristic of the heating element. Therefore, D3 did not disclose the

feature added to each of claims 1 and 14 of the fifth auxiliary request.

Fifth auxiliary request - Inventive step

The subject-matter of each of claims 1 and 14 was inventive in view of D3 and common general knowledge.

D3 disclosed using the absolute temperature after 0.4 seconds of the puff or the rate of temperature rise at the onset of the puff. D3 identified the period between 2 and 50 ms from the onset of the puff as providing the greatest resolution for the rate of temperature rise. Hence, the person skilled in the art would not have modified the system of D3 to determine the rate of temperature rise after 0.4 seconds.

Reasons for the Decision

1. The patent

1.1 A problem in an aerosol provision system such as an e-cigarette can arise if a portion of the wick adjacent a heating element becomes dry, for example if the supply of source liquid becomes unstable when the reservoir is becoming empty. This can lead to overheating of the heating element and potentially represent a risk for the user and for other components of the system. Overheating can also be the result of too much electrical power being provided to the heating element.

1.2 There is a desire to identify when there is rapid over-heating of a heating element, thereby allowing remedial action to be taken such as reducing power supply to the heating element or switching it off. The claimed

invention addresses this desire with an electronic aerosol provision system and a method of operating it.

1.3 The resistance of a heating element changes with temperature. It is therefore possible to use measurements of the resistance (or of a related electrical characteristic) to determine its temperature and detect overheating. As these measurements relate to the average temperature of the heating element, they are relatively insensitive to identifying the occurrence of localised overheating affecting only a small portion of the heating element. Greater sensitivity to localised overheating can be achieved by using a time derivative of the resistance (or related electrical characteristic) instead.

1.4 According to the independent claims, an indication of a derivative of an electrical characteristic of the heating element with respect to time is determined. Based on this indication of the time derivative, it is then determined whether or not a fault condition has arisen.

2. Main request - Novelty over D3

2.1 The proprietor contests the finding in the appealed decision that the subject-matter of claim 1 was not novel over D3.

2.2 D3 is in the same technical field of aerosol generating systems and discloses a system with, *inter alia*, a heating element and a liquid storage portion. D3 discloses determining if the liquid in the liquid storage portion has decreased to a threshold indicative of an empty or nearly empty liquid storage portion (see page 16, lines 22 to 24, and page 20, lines 17 to 24).

This determination relies on monitoring the rate of temperature rise of the heating element shortly after the onset of a puff, with its temperature being derived from measurements of its electrical resistance (page 15, line 18 to page 16, line 24 in connection with Figure 3; see also page 7, lines 5 to 18, page 17, lines 16 to 34, and claim 5 as for the reliance on the electrical resistance). When the liquid storage portion is empty or nearly empty, a strong rate of temperature rise is caused by less liquid than expected being present in the vicinity of the heating element because of insufficient liquid supply from the liquid storage portion (see page 13, lines 22 to 24; page 15, lines 32 to 34; page 17, lines 28 to 32).

2.3 The proprietor argues that a low amount of liquid remaining in a system designed to consume liquid was not a "fault condition" within the meaning of granted claim 1. D3 did not determine whether or not a fault condition had arisen, because a fault condition required the system to be broken and not working as expected.

2.4 The Board reaches a different conclusion. Neither claim 1 as granted nor the specification of the contested patent define the term "fault condition". Paragraph [0021] presents, within parentheses, "the occurrence of a hotspot / glowing / rapid over-heating of the heating element" as corresponding to a fault condition. Paragraph [0004] discloses that the supply of liquid "may become unstable when the reservoir is becoming empty" and that this can lead to rapid heating and hotspots (column 2, lines 1 to 5 and 22 to 23). Paragraphs [0005] and [0048] further indicate that the power supply to the heating element may be reduced or

stopped when "rapid over-heating", respectively "a fault condition", has occurred.

2.5 This can be compared with D3, which discloses that an empty or nearly empty liquid storage portion results in insufficient liquid supply to the heating element, which in turn causes rapid over-heating of the heating element and may cause the aerosol created not having the desired properties (see page 2, lines 5 to 11; page 17, lines 28 to 32; and curves 207 and 208 in Figure 2 in view of page 14, lines 11 to 23). According to D3, once it is determined that the liquid storage portion is empty or nearly empty, one or more actions may be taken such as deactivating the heating element and informing the user (see page 9, lines 1 to 19, and page 19, line 33 to page 20, line 27).

2.6 Therefore, the empty or nearly empty liquid storage portion in D3 is an abnormal condition which prevents the system from being further used as expected. Determining whether or not the liquid storage portion is empty or nearly empty thus anticipates the feature "determine whether or not a fault condition for the electric aerosol provision system has arisen" as required by claim 1.

2.7 It follows that the subject-matter of claim 1 is not novel over D3. Article 100(c) EPC thus prejudices maintenance of the patent as granted.

3. Fifth auxiliary request

3.1 Sufficiency of disclosure

3.1.1 Opponent 2 argues that the invention was not sufficiently disclosed because the contested patent

neither defined the term "temporally steady" nor explained how to configure the control circuitry to know when temporal steadiness was achieved.

3.1.2 As argued by the proprietor, the plain meaning of "temporally steady" means steady with respect to time, and it is not apparent why the term should be construed differently in the independent claims. Moreover, the claim does not require that the control circuitry knows that the temperature is temporally steady, but only that it is configured to determine the indication of the derivative during a period in which the temperature of the heating element is considered to be temporally steady. Paragraph [0050] of the specification explains that this may be "when the temperature of the heating element is expected to remain in a steady state with the aerosol provision system operating normally", excluding for instance a preheating phase.

3.1.3 It follows that the invention as defined in the independent claims is disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

3.2 Novelty over D3

3.2.1 The "electric heating element" of D3 converts an electric current into heat due to its electrical resistance (see also page 7, lines 21 to 23). D3 discloses an electrically resistive metallic tube as an example of the heating element (see page 4, lines 9 to 11 of D3). The heating element may be regarded as having various electrical characteristics, including conductance or current draw during operation. While charge may be seen as defining an electrical characteristic of an element such as a capacitor, which

is designed to accumulate electric charges, it is not an electrical characteristic of a heating element which serves to generate heat because of its electrical resistance. Hence the resistance of the electrical heating element is not an indication of a derivative of an electrical characteristic of the heating element with respect to time.

3.2.2 It follows that D3 does not disclose the feature "the control circuitry is configured to determine the indication of the derivative of the electrical characteristic of the heating element with respect to time during a period in which the temperature of the heating element is considered to be temporally steady" (claim 1), respectively "determining an indication of a derivative of an electrical characteristic of the heating element with respect to time during a period in which the temperature of the heating element is considered to be temporally steady". Therefore, the subject-matter of each of claims 1 and 14 is novel over D3.

3.3 Inventive step

3.3.1 As concluded above, the subject-matter of each of claims 1 and 14 is new over D3. The distinguishing feature allows a more sensitive detection of a localised overheating event (see the first sentence of paragraph [0050] of the contested patent).

3.3.2 D3 discloses that using the slope shortly after the onset of the puff (i.e. between 0 seconds and 0.2 seconds), when the temperature of the heating element varies rapidly, provides a faster insight and reduces the risk of poor aerosol properties (page 15, lines 10 to 17). In Figure 3, a comparison is made for the

derivatives in periods ending at 50 ms to 200 ms, with later periods not even considered. D3 identifies the period ending at 50 ms as providing the greatest resolution of the amount of liquid (Figure 3 and page 16, lines 11 to 17). Hence D3 discourages a determination based on a derivative of later periods, comprising periods in which the temperature of the heating element can be considered to be temporally steady. Moreover, nothing in Figure 2 of D3 suggests that the derivative after 400 ms would provide better accuracy. On the contrary, the difference in slope in Figure 2 appears to be greater earlier. The fact that derivatives allow to accurately determine changes in a parameter, as argued by opponent 2 with reference to textbook D5 as proof of common general knowledge, is not at stake and is also used in D3 in connection with Figure 3. However, it has no effect on the above assessment that the person skilled in the art is discouraged by D3 from determining a derivative of a later period of time.

3.3.3 Opponent 2 refers to the sentence on page 15, lines 10 to 13, of D3, which discloses that "a measure of the rate of temperature increase during an initial time of a puff over the life of the liquid storage portion can provide an alternative or additional means to detect an amount of the remaining liquid". In the context of the paragraph, in particular the sentence immediately preceding and following the quoted sentence, the "initial time of a puff" refers to the period between 0 seconds and 0.2 seconds. Therefore, also when measuring the rate of temperature increase as "additional means" to the temperature response as shown in Figure 2, the measurement of the rate of temperature increase would be carried out at the mentioned period up to 0.2 seconds. D3 not only gives no indication of measuring

the rate of temperature increase after 0.4 seconds, but as discussed above in relation to Figure 3, it identifies the period ending at 50 ms as providing the greatest resolution of the amount of liquid.

3.3.4 Therefore, the combination of D3 and common general knowledge would not lead to a system anticipating the system of claim 1 or to a method anticipating the method of claim 14. It follows that the subject-matter of each of claims 1 and 14 is inventive.

3.4 In summary, none of the objections against the fifth auxiliary request - which is the request found to be allowable in the appealed decision - is convincing. Therefore, there is no reason to set aside the appealed decision.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar: The Chair:

A. Chavinier-Tomsic M. Alvazzi Delfrate

Decision electronically authenticated