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Datasheet for the decision of 9 November 2021

Case Number: T 1243/19 - 3.2.01

Application Number: 15724575.4

Publication Number: 2991516

IPC: A24F47/00

Language of the proceedings: EN

Title of invention:
AN AEROSOL-GENERATING SYSTEM COMPRISING A MESH SUSCEPTOR

Patent Proprietor:
Philip Morris Products S.A.

Opponent:
Nicoventures Holdings Limited

Headword:

Relevant legal provisions:
EPC Art. 100(b), 54, 56

Keyword:
Insufficiency of disclosure (no)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:
G 0003/14

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 1243/19 - 3.2.01

D E C I S I O N
of Technical Board of Appeal 3.2.01
of 9 November 2021

Appellant: (Opponent)	Nicoventures Holdings Limited Globe House 1 Water Street London WC2R 3LA (GB)
Representative:	D Young & Co LLP 120 Holborn London EC1N 2DY (GB)
Respondent: (Patent Proprietor)	Philip Morris Products S.A. Quai Jeanrenaud 3 2000 Neuchâtel (CH)
Representative:	HGF 1 City Walk Leeds LS11 9DX (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 19 February 2019 concerning maintenance of the European Patent No. 2991516 in amended form.**

Composition of the Board:

Chairman	G. Pricolo
Members:	S. Mangin
	O. Loizou

Summary of Facts and Submissions

I. The appeal was filed by the appellant (opponent) against the interlocutory decision of the opposition division finding that, on the basis of the auxiliary request 1, the patent in suit (hereinafter "the patent") met the requirements of the EPC.

II. In particular, the opposition division held that
(1) the subject-matter of this request was novel over D1 (US 2013/0213419 A1), D2 (US 2014/0238423 A1) and D3 (WO 2010/045670 A1)/D3a (English translation of D3) and involved an inventive step starting from D3/D3a as closest prior art with common general knowledge or D5 (EP 2444112 A1) and starting from D5 as closest prior art in combination with D3/D3a, D2 or D1;
(2) dependent claim 4 of this request disclosed the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

III. Oral proceedings were held before the Board on 9 November 2021.

IV. The appellant (opponent) requested that the decision under appeal be set aside and the patent be revoked.

The respondent (patent proprietor) requested that the appeal be dismissed (main request) or in the alternative that the patent be maintained on the basis of one of the auxiliary requests 1A, 1B, 1C, 2, 2A, 2B, 2C, 3, 3A, 3B, 3C, 4, 4A, 4B, 4C as filed with its reply.

V. Independent claim 1 of the main request reads as follows:

A cartridge (200) for use in an aerosol-generating system, the aerosol-generating system comprising an aerosol-generating device (100), the cartridge configured to be used with the device, wherein the device comprises a device housing (101); an inductor coil (110) positioned on or within the housing; and a power supply (102) connected to the inductor coil and configured to provide a high frequency oscillating current to the inductor coil; the cartridge (200) comprising a cartridge housing (204) containing an aerosol-forming substrate and a mesh susceptor element (210) positioned to heat the aerosol-forming substrate, wherein the aerosol-forming substrate is a liquid at room temperature and can form a meniscus in interstices of the mesh susceptor element (210), and wherein the mesh susceptor element (210) comprises a plurality of filaments, each filament having a diameter between 8 µm and 100 µm, preferably between 8 µm and 50 µm, and more preferably between 8 µm and 50 µm, and more preferably between 8 µm and 39 µm.

VI. The following further documents are relevant for the decision
E3: Publication from Fastenal entitled "Magnetism in Stainless Steel Fasteners"
E4: Electromagnetic Compatibility Engineering, Henry W. Ott, page 243.

Reasons for the Decision

1. Sufficiency of disclosure - Article 100(b) EPC

The Board agrees with the opposition division's finding that the invention in accordance with dependent claim 4 is sufficiently disclosed for it to be carried out by a person skilled in the art. Reference is made to point 2.3 on page 4 of the decision of the opposition division.

Dependent claim 4 reads: "a cartridge according to any preceding claim wherein the mesh susceptor element (210) has a relative permeability between 500 and 40000".

1.1 The appellant argued that while the relative permeability varied with changes in flux density, and temperature, no information was provided in the patent as to the flux density and the temperature the permeability was to be measured at.
The appellant submitted E3 with the grounds of appeal, which specified certain conditions at which the relative permeability was to be measured. Without knowing the specific conditions at which the relative permeability was measured, it was difficult to assess whether one material fell within the claimed relative permeability range.
The appellant further noted that E4, submitted by the respondent with the reply to the grounds of appeal, showed on figure 6-21 that the relative permeability depended on the flux density and the magnetic field strength. Moreover, the final few sentences of E4 at page 264 stated that *"most magnetic material specifications give the best permeability, namely that at optimum frequency and field strength"*. Hence E4 supported the fact that the permeability of a material was dependent on certain environmental/ measurement conditions, and that without specifying such

conditions, there was an undue burden on the skilled person to reproduce this parameter.

1.2 The respondent argued that the appellant's allegation that claim 4 lacked sufficiency of disclosure was in fact a lack of clarity objection. The appellant failed to raise a serious doubt that the skilled person would be unable to make a cartridge falling within the scope of claim 4. The respondent held that the skilled person would choose a material for the susceptor within the range of claim 4 in view of the particular frequency disclosed in the patent. The skilled person would consult standard tables of relative permeability of various materials when designing a cartridge as the one disclosed in E4.

1.3 The Board does not agree with the appellant. Indeed as mentioned by the respondent, the appellant's objection is rather one of clarity than of sufficiency of disclosure, which the Board has no power to examine according to G3/14 as claim 4 corresponds to granted claim 5. In fact, the issue of "knowing when working within the forbidden area of the claim" addresses the question of the limits of protection conferred by the claim, and thus relates rather to a requirement of Article 84 EPC than of Article 83 EPC.
Furthermore, although the relative permeability may vary with the flux density, the magnetic field strength and temperature, tables such as the one disclosed in E4 may be used to select materials having a relative permeability in the range defined in claim 4.

Document E3 submitted by the appellant teaches that the magnetic properties of stainless steel vary with its microstructure. This document fails to provide evidence that temperature and flux density influences the

relative permeability in such a way that the skilled person is unable to provide the mesh susceptor element with a relative permeability in the range defined in claim 4.
Document E3, dated 2009, filed by the appellant with the statement of grounds of appeal, represents the skilled person's common general knowledge. The question of its admissibility can remain open since the Board concludes that E3 does not convincingly prove that claim 4 is insufficiently disclosed.

2. Novelty of claim 1 over D1-D3 - Article 54 EPC

The Board agrees with the opposition division's finding that the subject-matter of claim 1 is novel over D1-D3 (see points 2.6 on page 8 and point 2.4 on pages 4-7 of the appealed decision).

2.1 The appellant argued that the cartridges disclosed in documents D1-D3 were suitable *"for use in an aerosol generating system (...) comprising an aerosol generating device (...) wherein the device comprises a device housing, an inductor coil positioned on or within the housing; and a power supply (102) connected to the inductor coil and configured to provide high frequency oscillating current to the inductor coil"*.
Indeed, while the heating elements were resistively heated in D1, D2 and D3 via a DC current, the heating elements might alternatively be heated by induction.
In view of paragraphs [0010], [0019] and [0044] of the patent in suit, for a heating element to be considered as configured to be used with an inductive heating device, the heating element needed to have the following properties:
- to be electrically conductive; and
- to have a relative permeability between 1 and 40000.

D1 and D2 disclosed a heater made of electrically resistive (hence electrically conductive) materials, including stainless steel (paragraph [0026] of D1 and paragraph [0028] of D2), which had a relative permeability between 1 and 40000 according to E4. Hence the heater 14 of D1 and D2 was suitable for use with an induction heating device having the features of claim 1.
D3 disclosed an evaporator 22 made of a four-layer structure made of stainless steel, ASI 3014 and ASI 316 L (see table 2 of D3), which were electrically conductive and had a relative permeability between 1 and 40000 according to E3. Hence the evaporator 22 of D3 could be considered as a susceptor element capable of being inductively heated by an induction device having the features of claim 1.

The appellant emphasised that claim 1 was directed to the cartridge itself. Therefore, the inductive heating aerosol generating device per se did not fall within the scope of claim 1. As long as the prior art cartridge was suitable for being heated by a device including the features of claim 1, regardless of the actual configuration of the device (position of the induction coil, frequency, strength and form of the magnetic field) the prior art cartridge fell within the scope of claim 1. The appellant noted that there must exist a suitable magnetic field, with a suitable strength and if required magnetic field shaping components to specifically target or not target areas of the cartridge, which caused the heating element to heat to a suitable level, without overheating other components of the cartridge.

The appellant was further of the opinion that the features of the cartridge of D1, D2 and D3 would have little or no effect on the alternating magnetic field generated by the induction coil applied to the heater primarily because these features were formed from materials which did not absorb energy from the alternating magnetic field. In D1 and D2 the inner tube 62 and the outer tube 6 of the cartridge 70 were formed from a plastic /thermoplastic material and in D3, the sponge material 53 was made of cellulose, polyolefin or polyester fibre composite material, and the casing 3 was made of plastic material.

Furthermore the appellant noted that D3 (D3a, page 41, lines 27-29) described the possibility for inductively heating an evaporator, thereby providing a strong hint that the evaporator 22 as described in D3 could be inductively heated.

2.2 The respondent held that the expression "configured to" was not identical to "suitable for" and that none of the documents D1-D3 described cartridges which were configured to be used with aerosol-generating devices comprising an inductor coil as required by the claims. Instead the cartridges of documents D1-D3 were configured to be used with devices which directly supplied electrical power via electrical conduction.

Furthermore the cartridges in D1 and D2 were preferably the same size as a conventional cigarette (paragraph [0060] of D1 and [0011] of D2) and the device of D3 was shaped and sized to be easily handled and to be half the size of a pack of cigarettes (third paragraph on page 17 of D3a). In the housing of the cartridges of D1-D3 there was no room to place the inductor coil. The inductive coil which would be housed with a protective

and non-conductive housing should therefore be provided on the cartridges of D1-D3 which would substantially change the form of the overall aerosol-generating system. The inductive coil would in this configuration be too far away from the heater and too many components would be present between the coil and the heater to induce eddy currents in the heater.
Additionally inductively heating the heating elements would lead to the heat being transferred away from the heater by virtue of the connections to the batteries having lower resistances and higher thermal masses.

Finally while D3 disclosed induction heating among other alternative heating means, D3 did not disclose induction heating in combination with the specific embodiment referred to by the appellant.

2.3 The Board accepts that the expressions in claim 1: "a cartridge for use" and "a cartridge configured to be used" can be interpreted as "a cartridge suitable for". However, documents D1-D3 do not disclose directly and unambiguously a cartridge suitable to be used in an aerosol-generating system comprising an aerosol-generating device comprising a device housing, an inductor coil positioned on or within the housing; and a power supply connected to the inductor coil and configured to provide a high frequency oscillating current to the inductor coil.

The heating elements in D1-D3 heat via the Joule effect generated by the DC current flowing through them. While these heating elements may be heated by induction if a high frequency oscillating current is applied to an inductor coil located close to each respective heating element, it cannot be directly and unambiguously derived that the heat generated in the heating element

in the cartridges disclosed in D1-D3 would be appropriate to generate an aerosol. Furthermore the elements around the heating elements subject to the magnetic field generated by the inductive coil may shield the magnetic field or overheat depending on their nature rendering the system inappropriate for use.

Moreover, even if an inductor coil were provided to the cartridges disclosed in D1, D2 and D3 such that an alternating magnetic field would be targeted to the heating element, such an arrangement would not be suitable to heat the cartridge in an appropriate manner unless several selections were made.
Indeed, the skilled person would have to choose:
- an appropriate material for the heating material, i.e. a material that generates eddy currents when exposed to an alternating magnetic field such that the heat generated is appropriate to generate the aerosol;
- casings that are not conductive to avoid heating the cartridge by induction heating.

Considering D1, the appellant selected a wire mesh made of stainless steel among the various materials disclosed in paragraph [0025], as it is electrically conductive and has a relative permeability between 1 and 40000. However, to render the cartridge appropriate for induction heating a further selection of the materials for the inner and the outer tubes 6 and 62 is required. Indeed the inner and the outer tube should not be electrically conductive otherwise they would heat when subjected to the alternating magnetic field. Paragraph [0062] of D1 discloses that the outer tube 6 and the inner tube 62 may be formed of any suitable material or combination of materials including metals, alloys, plastics or composite materials containing one

or more of those materials, or thermoplastics that are suitable for food or pharmaceutical applications. The skilled person should therefore choose a non-conductive material for the outer and the inner tube among the listed materials.
Moreover, even if appropriate materials for the heater element, the inner tube and the outer tube were selected, there is still no evidence that the cartridge could be appropriately heated to generate the aerosol. Indeed the evaporator is to be heated to the specific temperature at which the aerosol is generated. The Board does not agree with the appellant that the magnetic field can always be appropriately chosen to heat the susceptor mesh at the right temperature to generate the aerosol. Indeed there are clearly practical limits to the magnetic field that can be applied to a cartridge in an aerosol-generating system which is intended for use by a person (e.g. amount of power, health hazards, etc).

The above considerations apply to the cartridge disclosed in D2, which is similar to the cartridge of D1.

As for D3, similarly to D1 and D2 the appellant has not shown that the cartridge of D3 is suitable to be heated by induction at the appropriate level for the aerosol to be generated. There is no evidence that it would be possible to find a suitable magnetic field that could be applied to the cartridge to heat the heater to an appropriate temperature. Restrictions in terms of positioning and arrangement of the coil on the cartridge as well as health related constraints for the user will not enable any kind of magnetic field to be applied.

Further the disclosure on page 41, lines 27 to 29 of D3a that *"the evaporator could also be heated with induction heat, radiant heat or microwaves instead of with ohmic heat. Nonelectric heating sources could also be used to evaporate the nicotine solution. Direct utilization of chemical reaction heat should also be mentioned as an example"* does not mean that the cartridge disclosed in figures 1-19 is suitable for induction heating. This passages generally mentions various ways of heating which would require an appropriate cartridge to be developed for each of the heating means disclosed.

3. Inventive step - Article 56 EPC

The Board confirms the findings of the opposition division that the subject-matter of claim 1 involves an inventive step either starting from D5 or starting from D3 as closest prior art.

3.1 The appellant held that starting from D5 in combination with D3 or starting from D3 in combination with the skilled person's common general knowledge or D5, the skilled person would arrive at the subject-matter of claim 1 without inventive skills.

3.1.1 D5 disclosed on figure 1 a high frequency coil 3 inductively heating an atomising core 1 made of stainless-steel fibres (first sentence of paragraph [0025] of D5). D3, column 3, lines 52-56 stated that *"if the atomising core 1 is made of conductive materials, a closed helix heater 2 can be set outside the atomising core 1"*, meaning that if the fibre material was made of conductive material no closed helix was present.

The appellant noted that according to paragraph [0013] and paragraph [0015], last sentence of the patent, the mesh may be grids or parallel arrays of filaments.
Therefore the only difference between the subject-matter of claim 1 and D5 was the diameter of the filaments between 8 µm and 100 µm.
According to the appellant the specific diameter of the filament did not have any effect. Indeed it could not be linked to the capillary action as the determining parameter was the interstices between the filaments and not the diameter of the filaments (paragraph [0014] of the patent).
The problem to be solved was therefore to select an appropriate stainless-steel fibre.
Page 23 of D3a disclosed in table 2 the use of fibres with a diameter falling within the range defined in claim 1. Furthermore page 21, lines 21-24 disclosed that "the capillary structure of the wick is suitable for absorbing the liquid nicotine solution".
The skilled person would therefore select fibres disclosed in table 2 of D3a and thereby arrive at the subject-matter of claim 1 without inventive skills.

3.1.2 Alternatively, the appellant argued that the skilled person would start from the teaching of D3 and combine it with either the skilled person's common general knowledge or D5 and arrive at the subject-matter of claim 1 without inventive skills.
The evaporator 22 of D3 (see table 2) fell within the definition of a susceptor element as given by the patent. Accordingly the evaporator 22 of D3 was suitable to be inductively heated. Given that D3 mentioned the possibility that the evaporator 22 be able to be inductively heated, the skilled person would naturally look to inductively heat the evaporator 22 of table 2.

Aside from the fact that the appellant considered that the cartridge of D3 did not need any modification to be inductively heated, the skilled person would be able to take the general teachings of D5 and apply these teachings to the system described in D3. D5 taught that it was possible to heat a cartridge, that the induction coil should be broadly aligned with the susceptor element and that no shielding material should be present between the induction coil and the susceptor element.

3.2 The respondent argued that the subject-matter of claim 1 involved an inventive step either starting from D5 or starting from D3, even though they did not consider D3 as an appropriate starting point.

3.2.1 Starting from D5, the respondent identified as a difference not only the diameter of the filaments, but also the aerosol-forming substrate that could form a meniscus in interstices of the mesh susceptor element and the cartridge comprising a cartridge housing. The respondent explained that in D5 the atomising core 1 was removable and disposable (last two sentences of the summary of the abstract and column 3, lines 47-52 and column 4, lines 15-16 of D5) and not the housing 18 comprising the atomising core and the holder 17 which were retained.
The problem to be solved might be considered as to efficiently heat the aerosol substrate.
The skilled person would not consult document D3 which disclosed cartridges where the heating element was resistively heated by applying a DC power source directly via electrical contacts. Indeed, D5, column 1, lines 19-22, explained that atomizers which were connected to DC power supplies were not usable as disposable atomizers.

But even if the skilled person were to consult D3, starting from D5, the skilled person would not and could not use the evaporator 22 in figure 14a of D3 and introduce it in the housing 18 of figure 1 of D5. The atomising core 1 of D5 was detachably set on the holder 17 and was replaceable in the second housing 18. Such an atomizing core must therefore have sufficient structural rigidity. Furthermore the atomizing core must have a suitable form to store the atomizing liquid. In contrast, the evaporator 22 of D3 did not have any of these attributes. It would therefore be clear to the skilled person that the evaporator 22 shown in figure 14a could not be used in the device of figure 1 of D5 since the evaporator 22 was not rigid enough to fulfil the function of a disposable evaporator and did not have the requisite storage capacity.

3.2.2 Furthermore the respondent was of the opinion that D3 did not represent a suitable starting point as it did not relate to inductive heating which was a key feature of the invention. But even if the skilled person were to start from D3, the skilled person would not replace the device for resistive heating by a device for induction heating.
Firstly, the skilled person could not agree that any of the heating methods disclosed on page 41 of D3a could be applied to the evaporator 22 of figure 14a. Indeed the evaporator 22 would not work using these alternative heating principles.
Secondly, the skilled person would not contemplate configuring the inhaler component 2 for use with an induction device around the inhaler component 2, since this would contradict the specific shape and size requirements described in D3a (first two sentences of the third paragraph on page 17 of D3a).

Thirdly, altering the inhaler component such that it was configured to be used with a device having an induction coil, would require a research project to attempt to produce a working solution, with significant period of trial and error. The appellant did not provide any reference to the common general knowledge which could lead to another conclusion.
Fourthly, the skilled person would not and could not replace the evaporator 22 of D3 with the atomising core 1 of D5 as they were different in shape and had different functions. But even if the skilled person would replace the evaporator 22 with the atomiser 1, the skilled person would not arrive at the subject-matter of claim 1 since the evaporator 22 did not have the required filament diameter.

3.3 The Board takes the view that the closest prior art is represented by D5 and that the subject-matter of claim 1 is not rendered obvious by the combination of D5 with D3. Furthermore, if the skilled person would start from D3, the subject-matter of claim 1 would not be rendered obvious either by the skilled person's common general knowledge or the teaching of D5.

3.3.1 As regards D5, the Board takes a different view than the respondent, namely that the subject-matter of claim 1 differs from D5 only in that the filaments of the mesh susceptor have a diameter between 8 µm and 100 µm.

As a matter of fact, in D5 the cartridge comprises a cartridge housing 18 containing a mesh susceptor (atomizing core 1) positioned to heat the aerosol forming substrate (located inside the atomizing core). Claim 1 does not distinguish between components that are, and components that are not, disposable. Therefore, while the cartridge housing 18 might indeed

not be disposable, it can still be considered part of the cartridge.
Furthermore the formation of a meniscus in interstices of the atomising core is implicit considering that the atomising core is made of stainless-steel fibers and that its function is to vaporise the aerosol forming substrate.

Clearly, the diameter of the filaments will have an impact on several properties of the atomising core:
- its wicking/capillary properties
- its capacity
- its rigidity
Therefore, the objective technical problem is to provide an appropriate size for the filaments of the atomising core.

Starting from the atomising core of D5, the skilled person would not consider D3 which evaporator does not have to hold a large volume of aerosol forming substrate and does not have to have a rigidity allowing it to be inserted and removed in the housing. Indeed in D3 the evaporator 22 only has a wicking function. The requirements for the evaporator 22 of D3 differ from those for the atomising core of D5.
Furthermore the skilled person would not implement the four-layer structure of the evaporator 22 of D3 in the device of D5 as its shape would not be appropriate. Indeed the elongated evaporator 22 is not appropriate for being inserted in and removed from the high frequency coil and be maintained in the holder 17 of the housing 18. Furthermore the elongated evaporator 22 does not have the capacity to hold large volume of aerosol forming substrate.

Similarly the heating mesh of D1 and D2 are not meant for retaining large quantities of aerosol forming substrate and for being inserted and removed.
The Board further notes that the appellant has not provided any evidence that it is common general knowledge to use fibre diameters between 8 µm and 100 µm in atomising cores such as the one of D5.

3.3.2 D3/D3a is not the closest prior art because it deals with resistive heating requiring a DC supply directly connected to the heating elements. This form of heating is very different from the induction heating used in the present invention. Indeed, induction heating requires specific arrangement of the cartridge including the heating element and the use of specific materials. Furthermore, the Board shares the view of the respondent that the general disclosure of induction heating among many other heating methods in D3a cannot be a disclosure of induction heating the cartridge described in the figures 1-21, which operates with DC current.
But even if the skilled person would start from D3, there is no incentive to modify the cartridge such that it can be used in a device comprising an inductor coil. As mentioned by the respondent, the cartridge of D3/D3a has been designed to have a specific shape, easy to handle by the user. The arrangement of a coil and a housing for the coil around the heating element would affect the shape of the device resulting in a device uneasy to handle.
Moreover the appellant has not provided any details where and how the inductive coil should be placed in the device of D3, and what values of the density flux and the frequency of the magnetic field should be applied to enable a proper functioning of the device.

4. It follows from the above that the appellant's case is not convincing and thus the contested decision is to be confirmed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Voyé G. Pricolo

Decision electronically authenticated