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**Datasheet for the decision
of 23 April 2021**

Case Number: T 2155/15 - 3.5.06

Application Number: 04256484.9

Publication Number: 1536313

IPC: G06F1/20

Language of the proceedings: EN

Title of invention:

Thermal solution for electronic devices

Patent Proprietor:

NeoGraf Solutions, LLC

Opponent:

SGL Carbon SE

Headword:

Thermal solution I/NEOGRAF

Relevant legal provisions:

EPC 1973 Art. 56

RPBA 2020 Art. 13(2)

Keyword:

Inventive step - (no)

Late-filed request - admitted (yes)

Decisions cited:

T 1294/16

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 2155/15 - 3.5.06

D E C I S I O N
of Technical Board of Appeal 3.5.06
of 23 April 2021

Appellant: SGL Carbon SE
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Representative: Botzenhardt, Sandra
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Respondent: NeoGraf Solutions, LLC
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Representative: Brand Murray Fuller LLP
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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
7 July 2015 concerning maintenance of the
European Patent No. 1536313 in amended form.**

Composition of the Board:

Chairman M. Müller
Members: A. Teale
A. Jimenez

Summary of Facts and Submissions

I. This appeal lies from the interlocutory decision of the opposition division, with reasons dispatched on 7 July 2015, that European patent no. EP 1 536 313 in amended form on the basis of auxiliary request 1 before it met the requirements of the EPC.

II. Opposition had been filed on the grounds according to Article 100(a) EPC in combination with Article 56 EPC, 100(b) and 100(c) EPC (1973). The opposition was based *inter alia*, on the following documents:

D3: US 5 991 155 A

D4: US 2002/0166658 A1.

The opposition division had renamed these documents to O3 and O4, respectively, in order to avoid confusion with documents cited earlier in the procedure, whereas the appellant still referred to D3 and D4 in its statement of grounds of appeal. The board adopts the appellant's numbering but stresses that D3 and D4 according to the appellant's submissions correspond to O3 and O4 in the decision under appeal.

III. The opponent filed a notice of appeal and paid the due appeal fee on 3 September 2015. A statement of grounds of appeal was received on 17 November 2015 in which the appellant (opponent) requested that the decision be set aside and the patent be revoked in its entirety because the subject-matter of amended claims 1-3 did not comply with Article 123(2) EPC, because amended claims 1-5 did not satisfy the requirements of Article 83 EPC, and

because amended claims 1-6 did not show an inventive step in view of, *inter alia*, D3 and D4.

- IV. The respondent (proprietor) requested, in a letter received on 2 June 2016, that the patent be maintained on the basis of the decision by the opposition division, i.e. that the appeal be dismissed and, effectively, the interlocutory decision by the opposition division to maintain the patent in amended form be confirmed. Regarding supporting arguments, the reasons of the decision under appeal were referred to.
- V. In an annex to a summons to oral proceedings, the board gave its preliminary opinion that the claims as maintained were clear and did not go beyond the application as originally filed, Articles 84 EPC 1973 and 123(2) EPC, but that they lacked an inventive step over, *inter alia*, documents D3 and D4, Article 56 EPC 1973.
- VI. In response to the summons, with a letter dated 22 March 2021, the respondent filed amended claims according to a new auxiliary request.
- VII. Oral proceedings were held as a video conference at the request of the respondent.
- VIII. Claim 1 according to the main request reads as follows.
- "A thermal dissipation and shielding system comprising:
an electronic device comprising a case, the case comprising a lower case and an upper case, a first component which comprises a heat source 100 adjacent an external surface of the device to which the first component transmits heat;
a conformable thermal solution 10 comprising two major surfaces 10a 10b, the thermal solution 10

positioned such that it is in operative contact with the first component and adhesively attached to the lower case of the device, wherein the thermal solution 10 shields the external surface of the device from heat generated by the first component,

wherein the thermal solution 10 comprises at least one sheet of compressed particles of exfoliated graphite having an in-plane thermal conductivity of at least 140 W/m-K [sic], the in-plane thermal conductivity of the at least one sheet of compressed particles of exfoliated graphite being greater than its through-plane thermal conductivity, the through-plane thermal conductivity being no greater than about 12 W/m-K [sic], and further wherein the surface area of one of the major surfaces of the thermal solution 10 is greater than the surface area of the first component."

Claim 1 according to the auxiliary request only differs from that of the main request in that the phrase "first component which comprises a heat source 100" is replaced by the expression "plurality of heat-generating components" and all four occurrences of the "first component" are replaced by the expression "heat-generating components".

IX. At the end of the oral proceedings, the chairman announced the decision of the board.

Reasons for the Decision

The invention

1. The invention relates to dissipating heat from an electronic component (a heat source), adjacent to an

external surface of a device, while shielding a user of the device from that heat (see the patent, paragraphs 1 and 17, and claim 1 of the patent as maintained). As a solution, it is proposed to use "flexible graphite", which has an in-plane thermal conductivity substantially higher than its through-plane thermal conductivity, i.e. a high "thermal anisotropic ratio" (still paragraph 17, and paragraph 32). More specifically, it is proposed (see claim 1) as a "thermal solution" to use "at least one sheet of compressed particles of exfoliated graphite" adhesively attached to the lower case of the device and in "operative contact" with the electronic component, where the exfoliated graphite has an in-plane thermal conductivity of at least 140 "W/m-K" and a through-plane thermal conductivity no greater than about 12 "W/m-K". (In the decision under appeal, points 79-81 of the reasons, it was found that the use of the symbol "-" is an obvious error and that the multiplication symbol "*" - or none (W/mK) - was intended instead. This finding is unchallenged in appeal, and the board concurs.) Moreover, the surface of the thermal solution should be greater than the electronic component.

The prior art

2. D3 discloses a flexible heat spreader sheet made from graphite or graphite composite materials which is adhesively attached to the lower casing of a small portable electronic device and in operative contact with a heat-generating first component (see column 1, lines 6-20 and 44-49; column 5, lines 35-53; column 6, lines 44-59; figures 1a, 4 and 11).
- 2.1 It is noted that certain graphite materials have limited flexibility, so that it may be difficult for

the sheet to contact the surface of the exothermic device and the casing and may occupy an undesirably large space if one wants to keep it away from "adjacent devices" (see column 2, line 52, to column 2, line 3; figure 11). It is therefore proposed to use a sheet of flexible material and an "abutting member", which keeps the sheet attached to the exothermic device (see column 2, lines 35-41 and 52-56; column 5, lines 15-33; column figures 1a and 4) and which conforms to the outside surface of the abutting member (column 5, lines 36-40).

- 2.2 Some embodiments discussed in D3 use line notches to improve the bending of the sheet over the abutting member (column 3, lines 24-31; column 5, line 62, to column 6, line 7; figures 3, 5 and 6). In one embodiment, however, the sheet is cut to have a "belt-like shape", i.e. a width much smaller than its length, so that bending is achieved without notches (column 7, lines 38-45; figures 7 and 8), making the sheet more "conformable".
- 2.3 In one embodiment an "elastic supporting frame" is used to provide an aerial layer under the abutting member so as to insulate that part of the casing from the heat (see column 7, lines 6-22). This effect may be enhanced if the sheet material is chosen to have a thermal anisotropic conductivity (lines 22-27).
- 2.4 The surface of the heat spreader sheet is larger than its contact area with the heat source, or indeed the entire surface of the latter (see, e.g., figure 1a). It is also stated in D3 that one abutting member may be used for a plurality of exothermic devices (column 7, line 65, to column 8, line 4).

3. D4 discloses a heat spreader sheet adhesively attached to an electronic component, which is made from compressed particles of exfoliated graphite, the material being chosen for its thermal anisotropic characteristics (see paragraphs 10-15). By way of example, it is disclosed that the in-plane conductivity may be between 220-250 W/mK and the through-plane conductivity between 4 and 5 W/mK (paragraph 41, see also paragraphs 42-43 and claims 10-17).

Article 56 EPC 1973

4. It is undisputed that D3 is a suitable starting point for assessing the inventive step of the claimed invention.

Main request

5. D3 does not disclose that the heat spreader sheet is made from compressed particles of exfoliated graphite and has the specifically claimed in-plane and through-plane thermal conductivities. It does disclose, however, the use of flexible, graphite material with a high anisotropic thermal conductivity.
6. D4 discloses a heat spreader sheet made from the claimed material, and thermal conductivities in the claimed ranges, i.e. above 140 W/mK and below 12 W/mK, respectively.
7. The respondent argues as follows.
 - i) D3 discloses the use of a graphite layer for heat dissipation, but not for heat shielding, the latter being achieved by the "abutting member", the supporting frame and the aerial

layer. The skilled person would thus have no incentive to replace the material of the heat spreader sheet by that discussed in D4. To increase the heat insulation effect, the skilled person would, if anything, chose the material known from D4 for the abutting member of D3.

- ii) Sheets of compressed particles of exfoliated graphite - the material as claimed - are too inflexible to be used as disclosed in D3. The skilled person would therefore not use the material claimed and known from D4 in the arrangement according to D3. And if the skilled person were to consider it anyway, they would also use the notches disclosed in D3 to achieve the necessary conformability.
- iii) D4 discloses the thickness of the disclosed material to be of the order of 15 mm, which is too thick for the miniaturization addressed in D3.

Accordingly, the skilled person would have no occasion to combine the teaching of D4 with that of D3 so as to produce a heat spreader shield as claimed.

At the same time, the respondent accepted that using the material from D4 for the heat spreader sheet of D3 would actually yield the invention as claimed.

- 8. *Re i)* The board does not accept the argument that D3 does not disclose a balanced heat dissipation and shielding. While it is true that D3 uses in particular the aerial layer for heat shielding, D3 states that the "heat generated by the exothermic device 1 is transmitted along [the] heat spreader sheet", that it is desirable for the sheet material to have a "higher thermal conductivity in the horizontal direction", and

that, therefore, an anisotropic material should be used. The board agrees with the appellant that a large heat spreader sheet with a higher in-plane than through-plane thermal conductivity automatically has, as used in D3, a certain shielding effect, as the part of the heat that is transmitted along the sheet is not transmitted across it. Moreover, this is not an accidental effect, but D3 specifically teaches to use the sheet in order to make the heat shielding effect of the aerial layer "more effective" (see column 7, lines 18-27).

The board therefore considers that the skilled person would - as opposed to just could - address the problem of increasing the heat insulation effect of the heat spreader sheet of D3 by considering a different material, especially one with a high anisotropic thermal ratio to avoid hot-spots on the casing.

During the oral proceedings, the respondent agreed that this constituted an appropriate objective technical problem according to the problem-solution-approach.

9. *Re ii)* The board agrees that the skilled person would limit their consideration to material which has the flexibility required for the uses according to D3. D4 however specifically discloses the material used to be conformable "to the surface topography" of the exothermic electronic component and the heat sink, and to have "excellent flexibility" and "good strength" (see paragraphs 6, 13 to 15, and 35). Moreover, as the notches are not disclosed as obligatory in D3, they cannot be an obstacle to the combination of D3 and D4 as required.

10. *Re iii)* In paragraph 45, D4 does not disclose the material to be exactly 15 mm but, in fact, to be 15 mm "or less" and, at the same time, states this to be suitable for use "in a laptop computer or hand-held device". Elsewhere (paragraph 38), D4 discloses the "inventive laminate" to be between 1 mm and 30 mm in thickness, depending on the requirements of the final component. In the board's judgement, this is consistent with the goal of D3 to improve heat management in compact and light-weight portable electronic apparatuses (see column 1, lines 16 to 28).

For these reasons, the board does not agree that the skilled person would hesitate to consider the material known from D4 as an alternative material for the heat spreader sheet of D3.

11. In summary, the board concludes that it would have been obvious for the skilled person to address the technical problem formulated in point 8 above and to consider, as a solution to that problem, the material of D4 for the heat spreader sheet of D3. Accordingly, it would have been obvious for the skilled person starting from (the notch-free embodiment of) D3 and having regard to D4 to arrive at the claimed invention, so that the subject-matter of claim 1 of the main request lacks an inventive step, Article 56 EPC 1973.

Auxiliary request

12. The auxiliary request is an amendment to the respondent's case which, according to Article 13(2) RPBA 2020, shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the respondent. The opponent had no objections to this auxiliary request being taken into

account, and it was possible for the board to deal with the request without undue delay. Hence the board, of its own motion, found the situation to be exceptional, Article 13(2) RPBA 2020, no arguments in this respect from the respondent being necessary. The board therefore admitted the auxiliary request. In so doing, the board concurred with the findings of T 1294/16 (points 18 and 19).

13. D3 discloses that one abutting member could be used for several exothermic devices (sentence bridging columns 7 and 8). As the respondent pointed out, this does not necessarily mean that the same heat spreader sheet is used to cover several exothermic devices. In theory, the heat spreader sheet could be cut so that each piece would touch only one of the exothermic devices.

13.1 The board considers this to be an unlikely arrangement, however, for several reasons. Firstly, using one large heat spreader sheet is simpler to produce and to process than a number of smaller pieces. Secondly, there is no need to shield the exothermic devices from each other. Thirdly, if there were more than two exothermic devices, the heat spreading from the "middle" ones would be inhibited if separate pieces were used.

13.2 For these reasons, the board considers that the claimed feature according to which the same "conformable thermal solution" shields the casing from heat generated by two or more heat-generated components would have been obvious for the skilled person, for instance in view of the cited passage of D3.

13.3 Therefore, the board concludes that also claim 1 of the auxiliary request lacks an inventive step over D3 in combination with D4, Article 56 EPC 1973.

Order

For these reasons it is decided that:

1. The decision is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:



K. Götz-Wein

M. Müller

Decision electronically authenticated