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Datasheet for the decision of 23 April 2021

Case Number: T 0545/19 - 3.5.06

Application Number: 08169306.1

Publication Number: 2026164

IPC: G06F1/18

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 II/NEOGRAF

Relevant legal provisions:
EPC Art. 56
RPBA Art. 12
RPBA 2020 Art. 13(2), 25(3)

Keyword:
Inventive step - (no)
Late-filed second auxiliary request - admitted (yes)
Late-filed third auxiliary request - admitted (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 0545/19 - 3.5.06

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

Appellant: (Opponent)	SGL Carbon SE Söhnleinstraße 8 65201 Wiesbaden (DE)
Respondent: (Patent Proprietor)	NeoGraf Solutions, LLC 11709 Madison Ave Lakewood, OH 44107 (US)
Representative:	Brand Murray Fuller LLP 50 Eastcastle Street London W1W 8EA (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 11 December 2018 concerning maintenance of the European Patent No. 2026164 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 11 December 2018, that European patent no. 2 026 164 in amended form on the basis of a set of claims filed during the oral proceedings 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 O3 and O4, respectively, in order to avoid confusion with documents cited earlier in the proceedings, whereas the appellant still referred to D3 and D4. 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 18 February 2019. A statement of grounds of appeal was received on 23 April 2019 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 and 7 did not comply with Article 123(2) EPC, because amended claims 1-7 did not satisfy the requirements of Article 83 EPC and because amended claim 1 did not show an inventive

step in view of, *inter alia*, the combination of D3 with D4, Article 56 EPC.

IV. The respondent (proprietor), in a letter received on 9 September 2019, re-filed claims 1-7 as maintained by the opposition division as its main request, and new sets of amended claims 1-7 according to a first and a second auxiliary request. It also requested 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. As an auxiliary request the respondent also requested that the patent be maintained on the basis of the first auxiliary request. Maintenance on the basis of the second auxiliary request was not specifically requested.

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. The same appeared to apply to the first auxiliary request. The board made no substantive comments with respect to the second auxiliary request because the appellant had not yet taken a position, and the respondent appeared not to have requested maintenance on this basis.

VI. Both parties responded to the summons, with letters dated 17 and 22 March 2021, respectively. The appellant in particular requested that the second auxiliary not be admitted because it was late filed, not a reaction to the board's communication and *prima facie* not

allowable. The respondent argued that it had, in the last paragraph of its reply to the appeal, at least implicitly requested maintenance of the patent on the basis of the second auxiliary request, and it requested that this request be admitted.

VII. Oral proceedings were held as a video conference at the request of the respondent. In its course, the respondent filed amended claims labelled "new main request" as its third auxiliary request. The appellant requested this request not be admitted as late-filed.

VIII. Claim 1 according to the main request reads as follows.

"A thermal dissipation and shielding system, comprising:

an electronic device having a case;

a first component (122) which comprises a heat source (100) adjacent an external surface of the device to which the first component transmits heat and a second component to which the first component transmits heat;

a conformable thermal solution (10) comprising two major surfaces (10a 10b), the thermal solution positioned such that it is in operative contact with the first component and attached to the case of the device and being interposed between the first and the second components, wherein the thermal solution shields the external surface of the device and the second component from heat from 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 about 140 W/m°K, 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."

Claim 1 according to the first auxiliary request is identical to that of the main request except that the two occurrences of "about" before 12 and 140 W/m°K have been deleted.

Claim 1 of the second auxiliary request is identical to claim 1 of the first auxiliary request except that the "conformable thermal solution" is now qualified as being "coherent" and "compressed to a thickness of from 0.075 mm to 3.75 mm and a density of from 0.1 to 1.5 grams per cubic centimeter and comprising two major surfaces".

Claim 1 according to the third auxiliary request is equivalent to claim 1 of the main request, the following features, corresponding to claim 2 of the main request, having been added at the end:

"... wherein the electronic device is a laptop computer (120), the first component (122) comprises the hard drive of the laptop computer and the second component comprises the chipset of the laptop computer."

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 and a second component, while shielding a user of the device and the second component 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, interposed between the electronic component which comprises the heat source and the second component and in "operative contact" to the electronic component, where the exfoliated graphite has an in-plane thermal conductivity of at least 140 W/mK and a through-plane thermal conductivity no greater that about 12 W/mK. Furthermore, it is disclosed that the "Flexible graphite sheet and foil are coherent, with good handling strength, and are suitably compressed, e.g. by roll pressing, to a thickness of about 0,075 mm to 3.75 mm and a typical density of about 0.1 to 1.5 grams per cubic centimeter (g/cm^3)" (see paragraph 45).

The prior art

2. D3 discloses a flexible heat spreader sheet made from graphite or graphite composite material 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 so that it occupies an undesirably large amount of 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 shape of the abutting member (column 5, lines 36-40).

2.2 Some embodiments discussed in D3 uses 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 the bending is achieved without notches (column 7, lines 38-45; figures 7 and 8), i.e. so that the sheet is more "conformable".

2.3 In an 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

increased if the sheet material is chosen to have a thermal anisotropic conductivity (lines 22-27).

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). Paragraph 35 in D4 is largely identical (except for its last sentence) to paragraph 45 of the patent in suit. In particular, D4 discloses precisely the sentence cited above (point 1) from the patent relating to the typical thickness and density ranges of the flexible graphite sheet.

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 or, as regards the second auxiliary request, the specifically claimed thickness and density ranges. D3 does disclose, however, the use of a flexible, graphite material with a high anisotropic thermal conductivity. Moreover, while D3 discloses a thermal solution interposed between an exothermic component and the casing, it does not disclose it also

being interposed between the exothermic "first" component and a "second" component, so that both the casing and the second component are shielded from the heat.

6. D4 discloses a heat spreader sheet made from the claimed material, thermal conductivities in the claimed ranges, i.e. above 140 W/mK and below 12 W/mK, respectively, and a thickness and a density in the ranges claimed in the second auxiliary request, i.e. a thickness between 0.075 mm to 3.75 mm and a density between 0.1 and 1.5 g/cm^3.

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 the material discussed in D4. If it were for increasing the heat insulation effect, the skilled person would, if anything, choose 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.

iv) Neither D3 nor D4 discloses the use of the thermal solution to shield both the casing and a "second" component from the heat produced by an exothermic "first" device. Where D3 discloses several components at all (see e.g. the "adjacent devices" 5 in figure 1a), the thermal solution is not interposed between them and it is stressed that a distance between both was required to avoid "contact or interference" (see e.g. D3, column 3, lines 4 to 7). Moreover, the relevant thermal solution of D3 includes not only the heat spreader sheet, and it is neither disclosed nor suggested to "interpose" this entire arrangement between two components.

Accordingly, the skilled person would have had no reason to combine the teaching of D4 with D3 so as to produce a heat spreader shield as claimed and, even if they had, there was no suggestion in the prior art to interpose it between two components as claimed.

8. *Re i)* The board does not agree with 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 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.

9. *Re ii)* The board agrees that the skilled person would limit their consideration to materials which have 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 being 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. *Re iv)* Claim 1 does not define what the second component is. In order to assess the obviousness of the "interposition" feature, it was discussed during oral proceedings how the claimed second component had to be construed.

11.1 The respondent argued that it was clear for the skilled person that it had to be an electronic component such as the chipset mentioned in claim 2 but also, for example, a camera, a mouse pad or a USB connector integrated into the casing. The respondent also stated that the second component had to be one which the skilled person would actively want to shield from heat.

11.2 The board has its doubts whether the skilled person would understand the second component to be, necessarily, an electronic component and to exclude non-electronic components such as, say, the rubber feet glued to the lower casing of a laptop computer. For the benefit of the respondent, however, the board assumed that the second component had to be an electronic one. The board also notes that claim 1 does not claim or imply that the second component *had to be* shielded from heat, but only that it *was* shielded by the claimed arrangement.

11.3 The board notes that it was commonly known for the casing of laptop computers to have several electronic components such as the examples given by the

respondent. It was also known that such components may be placed on both sides of the laptop. While a keyboard is, apparently, integrated in the upper part of the casing, a docking port or a battery may be integrated with the lower part. The respondent did not challenge these assumptions of fact during the oral proceedings. D3 discloses insulating from heat parts of an electronic device which are in contact with the user (see column 7, lines 20 to 22). A typical part would be the lower casing of a laptop which users place on their laps. Hence, if the thermal solution of D3 were used to protect the lower casing of a laptop, all components integrated with it would be shielded from the heat of the exothermic device. In other words, the board considers that any "second" component that happens to be located under the airal layer in figure 4 of D3 would, inevitably be shielded from heat.

11.4 The respondent objected that this argument was based on hindsight, as it contrived a casing in view of - and in order to - satisfy the requirements of the claimed invention.

11.5 The board disagrees. Since the claim fails to define the electronic device or its first and second components in any detail, it is justified to interpret them in the broadest reasonable sense. D3 discloses its thermal solution for use in any portable electronic apparatus (column 1, line 17) including ones which contain "second" components in various locations on the casing. Using the solution of D3 as intended, the skilled person would thus arrive at an arrangement in which such a "second" component is shielded from heat without exercising an inventive step.

12. In summary, the board concludes that it would have been obvious for the skilled person to address the technical problem of improving the heat shielding effect of the arrangement of D3 and to consider, as a solution to that problem, the material of D4 for the heat spreader sheet of D3. It would also have been obvious to use the obtained solution for any portable electronic apparatus with "second" components integrated with the casing in various places. 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.

First auxiliary request

13. The deletion of "about" from claim 1 has no relevance for the inventive step assessment above. The board thus concludes that claim 1 of the first auxiliary request also lacks an inventive step over D3 and D4, Article 56 EPC 1973.

Second auxiliary request

14. In the last paragraph of its reply to the appeal, the respondent stated that "In the event that the Board of Appeal is not minded to maintain the Patent on the basis of any of the Requests, oral proceedings are hereby requested". The board agrees with the respondent that this must be construed as an at least implicit request for the maintenance of the patent in amended form on the basis of the second auxiliary request.

15. According to Article 25(2) RPBA 2020, Article 12(4) RPBA 2007 continues to apply to the second auxiliary request, as the appeal was filed before the entry into force of the RPBA 2020 and the reply was filed in due time.

15.1 The second auxiliary request was filed with the respondent's reply to the appeal. It shall therefore, according to Article 12(4) RPBA 2007 in combination with Article 12(1) and (2) RPBA 2007, as a rule be taken into account. The board has discretion, however, not to take into account a request which could (and thus should) have been presented or was not admitted in the first instance proceedings. The latter is not the case here. As regards the former, the board takes the view that, on balance, the appellant had no occasion to file this further auxiliary request before the opposition division, because a higher-ranking set of claims, filed during the oral proceedings before the opposition division and only slightly amended over the claims as granted, was found allowable.

15.2 The board therefore did not exercise its discretion to hold inadmissible the second auxiliary request.

16. As regards the added feature relating to the thickness and the density of the graphite layer, the appellant referred to paragraph 35 in D4 and stressed that this passage discloses the claimed parameter ranges as known and as ones which the skilled person would typically choose.

16.1 The respondent objected that D4 did not teach to use just these parameter ranges to achieve the goal of the

present invention, namely to obtain a balanced heat dissipation and shielding system.

16.2 However, the patent does not disclose these parameter ranges as being of particular importance for that goal. Hence, the board concurs with the appellant that the claimed thickness and density parameters, disclosed in the patent in just the same words as those used in D4, must be considered to be known at least from D4 and to be obvious when producing the material of D4. In passing, the board notes that the primary goal of achieving balanced heat dissipation and shielding is achieved by the thermal conductivity values also and separately claimed, and that the thickness and density values of the material in question have to be chosen so as not to interfere with the required thermal conductivities.

17. The board therefore concludes that claim 1 of the second auxiliary request also lacks an inventive step over D3 and D4, Article 56 EPC 1973.

Third auxiliary request

18. The third 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. In view of the above discussion (point 15), the board stresses that Article 13(2) RPBA 2020 puts - deliberately and clearly - a much more stringent requirement on the admittance of the amendment than Article 12(4) RPBA 2007.

19. The appellant objected that the third auxiliary request was late-filed. The respondent argued that it only became clear to it during the oral proceedings how broad an interpretation on the claimed second component the board would place. The board's objection to inventive step of the "interposition" feature was different from that given in the summons to oral proceedings, and the third auxiliary request was filed in response to that objection.

19.1 The board accepts that the reasoning given above differs from the shorter one according to the board's preliminary opinion (point 23).

19.2 Even so, the respondent was informed of a preliminary negative opinion of the board vis-à-vis the feature in question and cannot, therefore, be surprised that the board came to a negative finding during the oral proceedings. Therefore, the board does not accept the respondent's argument as a justification for the filing of the third auxiliary request only at the end of the oral proceedings and after all other requests had been exhaustively discussed.

19.3 In passing, the board also notes the following. If oral proceedings are to serve a purpose, it would seem that there must be room for the discussion during oral proceedings to deviate to an extent from the preceding written submissions - at least in terms of facts and arguments within the meaning of Article 114 EPC. It would therefore be necessary for everybody concerned, the parties and the board, to have some leeway to adapt their opinions in view of that discussion without such a change, in and by itself, being sufficient to justify further amendments.

19.4 The board therefore decided not to admit the third auxiliary request under Article 13(2) RPBA 2020.

Order

For these reasons it is decided that:

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

The Registrar: The Chairman:

A. Voyé M. Müller

Decision electronically authenticated