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**Datasheet for the decision
of 10 February 2014**

Case Number: T 1187/09 - 3.5.02

Application Number: 07021310.3

Publication Number: 1909541

IPC: H05B41/282, H05B41/02, H01G2/06

Language of the proceedings: EN

Title of invention:
Lighting device of discharge lamp, illumination apparatus and
illumination system

Applicant:
Panasonic Corporation

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)



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Case Number: T 1187/09 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 10 February 2014

Appellant: Panasonic Corporation
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted on 19 December 2008 refusing European patent application No. 07021310.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: M. Ruggiu
Members: R. Lord
W. Ungler

Summary of Facts and Submissions

I. This is an appeal of the applicant against the decision of the examining division to refuse European patent application No. 07 021 310.3. The reason given for the refusal was that the subject-matter of the independent claim 1 then on file did not involve an inventive step according to Article 56 EPC.

II. The following documents of the prior art cited during the procedure before the examining division are relevant for this decision:

D1: WO 01/97572 A1,
D2: US 4 578 737 A,
D3: DE 39 29 791 A1,
D4: EP 1 263 270 A2.

III. In a communication accompanying a summons to oral proceedings, dated 19 November 2013, the board indicated *inter alia* its preliminary opinion that the subject-matter of claim 1 as addressed in the decision under appeal did not involve an inventive step.

With letter dated 7 January 2014 the appellant filed a set of claims indicated as being a "Main Request", which claims were identical to those which were addressed in the decision under appeal. In that letter the appellant also presented observations on the comments in the board's communication of 19 November 2013.

Oral proceedings before the board took place on 10 February 2014. The appellant requested that the decision under appeal be set aside and that a patent be

granted on the basis of claims 1 to 5 of the main request filed with letter dated 7 January 2014.

IV. Claim 1 according to the appellant's sole request reads as follows:

"A lighting device for a lamp device, comprising: a circuit board; and film capacitors, wherein each film capacitor comprises polypropylene films and lead wires, wherein a diameter of the lead wires is 0.6 mm or less, and a material of the lead wires has a thermal conductivity lower than a thermal conductivity of copper, and terminals and internal materials of the film capacitors are leadless, wherein the film capacitors are constructed by a combination of a polypropylene film and an aluminum foil, or by an aluminum-deposited polypropylene film, wherein the film capacitors are packaged on the circuit board by using leadless flow solders."

V. The appellant essentially argued as follows:

The document D1 did not represent the closest prior art, because it did not disclose any of the main aspects of the invention.

The features of the independent claim 1 gave rise to a combination effect, and therefore involved an inventive step. In particular they gave rise to the "self-healing" effect described in the application, which effect was established by the experimental data provided in the letters dated 14 February 2009 and 7 January 2014. Moreover, the maximum value for the diameter of the lead wires defined in the claim was, in combination with the other defined features,

responsible for "critical meanings" which established the presence of an inventive step.

D1 did not disclose the use of flow soldering with leadless solder.

Contrary to what was argued in the decision under appeal, the claimed invention was not based on a sequence of developments which was a "one-way street".

Reasons for the Decision

1. The appeal is admissible.
2. The board shares the opinion of the examining division that the document D1 represents the best starting point for the assessment of inventive step.
 - 2.1 D1 describes (see Fig. 1 and page 7, line 18 to page 9, line 16) an electronic ballast for a lamp, thus disclosing, in the wording of the present claim 1, a lighting device for a lamp device. This ballast comprises a circuit board (10) and film capacitors (77, 87 to 89, see also page 23, lines 13 to 17). Such film capacitors inherently comprise dielectric films and lead wires. It is moreover evident from the disclosure of page 9, lines 10 to 16 and page 28, lines 4 to 11 that the various components, including the film capacitors, are connected to the circuit board by moving the circuit board through a soldering bath.
 - 2.2 The device of the present claim 1 thus differs from that of D1 by the following features (reference signs introduced by the board):

- (a) the soldering of the capacitors on the circuit board is carried out by using leadless flow solders;
- (b) the terminals and internal materials of the film capacitors are leadless;
- (c) the dielectric films of the film capacitors are of polypropylene;
- (d) the film capacitors are constructed by a combination of said polypropylene films with aluminium foil, or by said polypropylene films being aluminium-deposited;
- (e) the material of the lead wires of the film capacitors has a thermal conductivity lower than that of copper;
- (f) the lead wires of the film capacitors have a diameter of 0.6 mm or less.

2.3 Feature (a) above has the technical effect of avoiding the use of lead, thereby solving the problem of reducing environmental damage. In this context, the board agrees with the opinion expressed by the examining division in paragraph II, 1.2 of the decision under appeal that the skilled person working with the lighting device of D1 would have been well aware of this problem and of the need to solve it by use of leadless solder. This knowledge is illustrated by document D4, paragraphs [0008] and [0009] of which describe the problem and solution respectively, and in particular the use of tin-zinc solder. Paragraphs [0009] and [0010] of that document also disclose that this development has the consequence of higher soldering temperatures, with thus increased risk of thermal damage to the components being soldered.

- 2.4 The desirability of feature (b) would follow directly from the same considerations relating to environmental damage.
- 2.5 D1 does not contain any disclosure concerning the type of film capacitor to use in the ballast circuit. Thus, taking into account the common knowledge discussed in the previous paragraph, the skilled person is presented with the problem of selecting a type of film capacitor to use in the ballast circuit of D1 which is compatible with the heating arising from the use of leadless solder. He would therefore consider the teaching of document D3 to be relevant, since this also concerns film capacitors which are compatible with high soldering temperatures (see in particular page 2, lines 21 to 24 and 36 to 41). The preferred solution described in that document (see page 2, lines 30 to 33) is to construct the capacitors from polypropylene films coated with aluminium, thus rendering obvious features (c) and (d) above. The board also notes that all of the components of the capacitor described in D3 are lead-free, so that feature (b) of the claim would be rendered obvious also by this teaching.
- 2.6 D3 does not contain any specific teaching concerning the material or dimensions of the lead wires, although it does disclose (see page 2, lines 34 to 41) that heat conduction along the lead wires is the cause of thermal damage during soldering, together with examples of the temperatures which can be expected. The skilled person would therefore look to other documents containing relevant teaching, and would therefore take into account the teaching of D2, since it is apparent from the abstract of this document that it addresses this issue. That document discloses (see in particular column 1, lines 55 to 58 and column 2, line 66 to

column 3, line 6) that thermal damage of a film capacitor during soldering can be reduced by fabricating the lead wires of a material having "relatively poor thermal conductivity" and which is thin ("thickness of from about 0.1 to 0.5 mm"). The board considers that the expression "relatively poor thermal conductivity" implies a thermal conductivity less than that of copper, since copper has a very high thermal conductivity. This disclosure therefore renders obvious feature (e) of the present claim.

2.7 D2 describes that the leads should be in the form of thin sheet metal, whereas the present claim defines in feature (f) a diameter of 0.6 mm or less, thus implying a circular cross-section. The cross-sectional shape of the lead wires does not however appear to have any technical relevance, and the particular limit value for the diameter cannot be considered to be of any significance because the maximum diameter required to prevent thermal damage would depend not just on the parameters defined in the present claim, but also on a variety of other properties such as the length of the lead wire, the construction of the capacitor housing and the actual temperature of the solder bath. Therefore this feature also cannot contribute to the presence of an inventive step.

3. The appellant's counter-arguments are not found convincing, for the following reasons.

3.1 The appellant argued that D1 did not represent the closest prior art because it did not disclose any of the main aspects of the invention. However, given the disclosure of that document indicated in paragraph 2.1 above, and that the appellant did not identify any other document which might represent a more suitable

starting point for the assessment of inventive step, the board sees no reason to deviate from the position established in the decision under appeal. The board notes in particular that D1 does not contain any teaching leading away from the claimed invention.

3.2 The appellant presented a number of arguments relating to the existence of a combination effect between the claimed features. However, the board considers that no such effect has been demonstrated, and that to the contrary each of the characterising features with respect to D1 has exactly the effect which the skilled person would expect. In particular, the board considers that the effect of the material and dimensions of the lead wires on the thermal damage to the capacitor occurring during soldering is limited to that based on the amount of heat conduction along those wires, as taught by both D2 and D3 (see the passages cited in paragraph 2.6 above).

3.3 The appellant raised a number of arguments relating to the "self-healing" effect described in paragraph [0005] of the application (A1 publication). The board understands this effect and the associated degradation effects to be merely examples of the type of thermal damage discussed in documents D2 and D3. Moreover, as was indicated in section II, 2.7 of the decision under appeal, it is not credible that the mere combination of an aluminium-deposited polypropylene film capacitor structure with lead wires having the claimed thermal conductivity and diameter would lead to precisely the amount of heating required to achieve the level of vaporisation of the aluminium necessary for the "self-healing" of damage. To the contrary, in the opinion of the board, this effect would only arise in the case of a specific profile of heating over time, which would

depend on many other factors beyond this simple combination, for instance those mentioned in paragraph 2.7 above. Thus the board concurs with the opinion expressed by the examining division in the cited section of the decision under appeal that the teaching of the application in this respect is simply to reduce thermal damage by limiting the flow of heat to the capacitor, and is thus nothing more than what is taught by D2 and D3. Given this conclusion, the question as to what exact effect might be demonstrated by the experimental data submitted by the appellant in the letters of 14 February 2009 and 7 January 2014 is of no relevance.

- 3.4 The appellant's argument that the definition of the maximum diameter of the lead wires contributes to "critical meanings" is addressed by the points raised in paragraph 2.7 above.
- 3.5 The appellant has also argued that D1 does not disclose the use of flow soldering with leadless solder. This statement is in itself true, but merely establishes that this feature is one of the distinguishing features over D1, which is acknowledged in paragraph 2.2(a) above. To the contrary, the above argumentation is based on the fact that D1 does not contain any precise teaching in this respect, so that the skilled person is required to derive the necessary teaching from his common knowledge in the technical field and/or documents of which he is aware, as discussed in particular in paragraph 2.3 above. In this context, the fact that the invention described in D4 relates to reflow soldering is of no relevance, because that document was cited only as evidence of the common knowledge relating to the undesired environmental effects of lead-containing solders, which clearly

applies to all types of solder. The board observes also in this respect that D3 explicitly refers to flow soldering at page 2, lines 39 and 40 ("Schwalllöten").

3.6 Finally the appellant has argued that the decision under appeal was incorrect in arguing that the combination of developments was based on a "one-way street". The board accepts that a number of options were available to the skilled person, so that it was indeed not strictly correct to speak of a one-way street. Nonetheless, the board considers that the sequence of developments discussed in paragraphs 2.3 to 2.7 above would have been obvious to the skilled person for the reasons indicated there.

4. For the above reasons, the board concludes that the subject-matter of claim 1 of the appellant's sole request does not involve an inventive step according to Article 56 EPC. Therefore the appeal has to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

M. Ruggiu

Decision electronically authenticated