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**Datasheet for the decision  
of 11 March 2022**

**Case Number:** T 0142/17 - 3.4.01

**Application Number:** 05791937.5

**Publication Number:** 1808050

**IPC:** H05B33/08

**Language of the proceedings:** EN

**Title of invention:**

METHOD FOR DRIVING A LED BASED LIGHTING DEVICE

**Applicant:**

Signify Holding B.V.

**Headword:**

Driving of LED-based lighting devices / Signify Holding B.V.

**Relevant legal provisions:**

RPBA 2020 Art. 13(2)

EPC Art. 123(2), 56

**Keyword:**

Amendment after expiry of period in R. 100(2) EPC  
communication - exceptional circumstances (yes)  
Inventive step - after amendment

**Decisions cited:**

T 0939/92



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Case Number: T 0142/17 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 11 March 2022**

**Appellant:** Signify Holding B.V.  
(Applicant) High Tech Campus 48  
5656 AE Eindhoven (NL)

**Representative:** Verweij, Petronella Daniëlle  
Signify Netherlands B.V.  
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**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 1 September  
2016 refusing European patent application No.  
05791937.5 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** P. Scriven  
**Members:** P. Fontenay  
D. Rogers

## **Summary of Facts and Submissions**

- I. This decision relates to the applicant's appeal of the Examining Division's decision to refuse European patent application 05 791 937.
  
- II. In their decision to refuse the application, the Examining Division held that the claims of the sole request on file comprised subject-matter extending beyond the content of the application as filed, contrary to Article 123(2) EPC. Concretely, they considered that the feature of the measurement means having a voltage source and a current meter had no basis in the original application documents.
  
- III. The Examining Division also held that the claims did not meet the requirements of Article 84 EPC as to clarity, because independent claims 1 and 7 referred to "a predetermined measuring current" without specifying what means could supply such a current. It was further observed that the terminology used in independent claims 1 and 7 was inconsistent.
  
- IV. The Examining Division further held that the subject-matter of independent claims 1 and 7 was not inventive in the sense of Article 56 EPC over document:

D3: GB-A-2 224 374,

considered as closest prior art, in combination with common general knowledge or with the teaching of document:

D2: WO-A-02/47438.

D2 was considered explicitly to disclose the switching off of one LED and the use of a measurement current for measuring the junction temperature.

None of the dependent claims 2-6 and 8 was considered to define inventive subject-matter.

V. The appellant requested that the decision be set aside and that a patent be granted on the basis of a set of claims according to a new main request or, in the alternative, according to a first auxiliary request. Both requests were submitted with the statement of grounds.

VI. In the appellant's view, the objection regarding added subject-matter was based on a misunderstanding since the description "very clearly" disclosed measuring means including a voltage source and a current meter.

The claims had been amended to address the clarity objections in the impugned decision. In this respect, the term "predetermined measuring current" no longer appeared in the claims, which were restricted to measuring the current due to a predetermined measuring voltage".

With regard, to the objection of lack of inventive step, it was emphasised that D3 disclosed a LED powered

by a current source and that the differences between the claimed subject-matter and the disclosure of D3 were more significant than acknowledged by the Examining Division. The voltmeter 4 in figure 1 of D3 could not be equated with a voltage source, as the Examining Division had done. Moreover, it was not suggested, in D2, to switch between a power supply in the active mode and a voltage source in the measuring mode. The technical effect obtained by the claimed subject-matter consisted in defining measurement conditions different from the operating conditions, allowing for more accurate measurement results. As a consequence, a more accurate control of the adjustable power supply was achieved in the active mode.

VII. In a communication under Article 15 RPBA, the appellant was informed of the Board's preliminary opinion.

It was acknowledged that the measuring means consisting of a voltage source and a current meter in combination was unambiguously supported by the original disclosure (Article 123(2) EPC). However, the repeated statements in the description, that the alternative measuring means consisting of a current source and a voltage meter in combination was also envisageable in the framework of present invention (page 3, lines 3-19; page 4, lines 5-9; page 6, lines 4-17; page 7, lines 23-25; page 10, lines 12-20), generated doubts as to the actual definition of the invention for which protection was sought.

With regard to the issue of inventive step, it was acknowledged that D3 constituted a valid starting point on the basis of which the existence of inventive step could be assessed. As underlined by the appellant, the

claimed subject-matter appeared to differ from the lighting device known from D3 in more respects than recognised in the impugned decision. However, in the absence of any specification, in the claim, as to the characteristics of the measurement voltage source and as to the controlled electrical power supply, the effects relied upon by the appellant did not appear to apply over the whole scope of the claim and, accordingly, could not be taken into account when deciding on the existence of an inventive step (see T 939/92 *Triazoles*, OJ EPO 1996, 309, points 2.4 to 2.6). For this reason, the technical problem addressed in the description did not appear to be solved by the claimed subject-matter.

- VIII. In reply to the Board's communication, the appellant filed a new main request, replacing the two requests on file. The new request included an amended version of the description, in which it was explicitly acknowledged that the alternative measuring means combining a current source and a voltage meter did not correspond to the claimed invention. The feature of the measurement voltage source had been amended so as to specify that it was non-adjustable and of a higher precision than the adjustable electrical power supply.
- IX. In the course of the oral proceedings, the request was further amended to address residual clarity issues in the description and dependent claims.

X. Claim 1 reads:

*Lighting device, comprising:*

- *at least one LED (1a, 1b),*
- *an adjustable electrical power supply (3a, 3b) for driving the LED (1a, 1b) in an active mode, by providing a forward driving voltage to the LED (1a, 1b),*
- *a control device that comprises:*
  - *a measuring means (7, 9) having a measurement voltage source (7) and a current meter (9), the measuring means (7, 9) being constructed to determine a value of an electric current through said LED (1a, 1b) at a predetermined measuring voltage across said LED (1a, 1b) when the LED (1a, 1b) is connected to the measuring means (7, 9), said current being indicative of an electrical resistance of said LED (1a, 1b),*
  - *a switch (5a, 5b) for selectively connecting said LED (1a, 1b) to said measuring means (7, 9) or to the adjustable power supply (3a, 3b),*
  - *a power supply control means (11) connected the current meter (9) and to the electrical power supply (3a, 3b) and constructed to provide a control signal to the adjustable electrical power supply (3a, 3b) for driving the LED (1a, 1b), and*
  - *an information retrieval means, connected to the power supply control means (11), containing information on the control signal as a function of the determined value of the current through said LED (1a, b),*



wherein

- the power supply control means (11) is constructed to retrieve the control signal from the information retrieval means on basis of the determined current,
- the measurement voltage source (7) is non-adjustable, of a higher precision than the adjustable electrical power supply (3a, 3b), and constructed for providing power to the LED (1a, 1b) when the LED (1a, 1b) is connected to the measuring means (7, 9), by supplying the predetermined measuring voltage to the LED (1a, 1b),
- said predetermined measuring voltage is a voltage in a forward direction that is smaller than the forward driving voltage of said LED (1a, 1b) and that causes a current through said LED (1a, 1b) which is less than half of a lowest driving current provided to said LED (1a, 1b) by the adjustable electrical power supply (3a, 3b) in the active mode.

## **Reasons for the Decision**

*Admissibility (Article 13(2) RPBA 2020)*

1. The new request was filed in reaction to the Board's communication under Article 15 RPBA. It addresses the contradiction between the claim wording and the description as to the nature of the measuring means. The notion of "forward driving voltage" has been clarified, as claim 1 specifies that the forward

driving voltage corresponds to a voltage causing a current through said LED which is less than half of a lowest driving current provided to said LED by the adjustable electrical power supply in the active mode.

2. Claim 1 was further amended to specify that the measurement voltage source is of a higher precision than the adjustable electrical power supply, thus addressing the misgivings of the Board as to the absence of effect deriving from the claim's wording.
3. Both objections as to lack of clarity, as well as the finding regarding the absence of effect applying over the whole scope of the claim, were raised for the first time in the board's provisional opinion. They constitute exceptional circumstances which justify the admission of the new request, which constitutes a promising attempt at overcoming all outstanding objections.

*Added subject-matter (Article 123(2) EPC)*

4. Claim 1 stems from a combination of original claims 1 to 6, 10, and 11.
5. The feature of an adjustable electrical power supply for driving the LED in an active mode, has been further specified to recite that it provides a forward driving voltage to the LED. A basis for the amendment is to be found in the passage on page 5, lines 9-17, of the original application where it is stated that the adjustable electrical power supply may comprise a battery or other supply with circuitry for setting a desired driving voltage or driving current for the LED. The board is satisfied that the reference, in the

description, to a desired voltage or desired current supports the general reference in the claim to the provision of a forward voltage.

6. Original claims 2 and 3, as well as the original application, consistently refer to two different kinds of measuring means: a voltage source in combination with a current meter, and a current source in combination with a voltage meter (see page 3, lines 3-9; 14-17; 20-22; page 4, lines 5-9; page 6, lines 4-17; page 7, lines 11-22). They are presented as equivalent in that they both allow the determination of a voltage and corresponding current value. The knowledge of both parameters is indicative of the resistance and, therefore, the temperature of the LED junction (page 2, lines 19-26). The information thus obtained is used to control the power delivered to the LED and, thus, its luminous output (page 2, lines 27-30).
7. It is established jurisprudence of the boards of appeal that the claims may be amended in the course of the examination proceedings by introducing features of the description which have been described in relation with specific embodiments of the invention. Both alternatives regarding the measuring means have been disclosed.
8. The passage of the original description on page 7, lines 23-25,

*A third embodiment, not shown here, comprises a driving current source that can be set to a measurement current for the measurement phase and with a switch that allows 25 for monitoring the voltage across*

*the LED.*

does not in any way suggest that the current meter and the voltage source alone are alternatives, as held the Examining Division. On the contrary, it is consistent with the repeated indications, throughout the description, as to the alternative measuring means which were envisaged. It emphasises that the function achieved by the measurement voltage together with the current meter in the embodiment of Figure 2, as described on page 7, lines 11-19, can be provided, alternatively, by an adjustable driving current source in combination with a voltage meter.

9. Claim 1 has been further amended by incorporating a definition of the forward driving voltage being smaller than the forward driving voltage of the LED in the active mode; and causing a current through said LED which is less than half the lowest driving current in the active mode. The added feature derives from the definition of the voltage to be applied by the measuring means on page 3, lines 24-26. The passage refers explicitly to the alternative of the measuring means comprising a voltage source and a current meter.
10. Claim 1 further recites that the measurement voltage source is non-adjustable, of a higher precision than the adjustable electrical power supply, as at page 4, lines 12-14 of the original description. Said feature is disclosed in combination with the switch means allowing for selective connection to the adjustable power supply means in the active mode or to the measuring means during the measuring phases.

11. The board is satisfied that the features regarding the measurement voltage source on page 4, lines 12-14, which immediately follow the definition in the previous paragraph of the forward driving voltage, allows for a combination of both aspects in the independent claim.
12. The subject-matter of claim 1 derives directly and unambiguously from the original application documents, as required under Article 123(2) EPC.

*Clarity - Article 84 EPC*

13. The description has been amended to remove any contradiction with the claims. It explicitly states that the measuring means according to the invention combine a voltage source and a current meter, and that the alternative of a current source and voltage meter does not fall under the definition of the invention.
14. The term "forward driving voltage", in claim 1, has a recognised meaning in connection with diodes. It refers to the voltage that drives the LED, that is, the voltage that allows current to flow through said LED in the direction of conductivity.
15. The definition of the predetermined measuring voltage, as being a voltage in a forward direction that causes a current through said LED which is less than half of a lowest driving current provided to said LED by the adjustable electrical power supply in the active mode, is clear in the context of the invention.
16. While it is acknowledged that the characteristic associating the voltage to the current intensity depends on the temperature of the LED junction, as for

example illustrated in Figure 4 of the application, the claim feature is to be construed as a condition applying over the whole range of envisageable temperatures. In other words, the voltage to be selected is to be less than half the lowest current intensity that can be observed in the active mode over the range of expected junction temperatures.

17. The claimed subject-matter is clearly defined.

*Inventive step (Article 56 EPC)*

18. Document D3 discloses (D3, Figure 1) a lighting device with a LED (diode 1), an adjustable electrical power supply (current source 2) for driving the LED, and a control device providing a control signal to the adjustable electrical power supply for driving the LED (cf. page 4, lines 7-11). The control device consists of measuring means, which combine a voltmeter 4 and a current meter 3, and of control means in the form of a signal processor 5 (page 2, line 24 - page 3, line 7). The measuring means are arranged to measure both the voltage applied through the LED and the electric current flowing therethrough.
19. The control means of D3 further comprise an information (temperature) retrieval means (page 3, line 25 - page 4, line 7; Figure 2) connected to the power supply control means, containing information on the control signal to be applied to the power supply as a function of the measured parameters. In D3, the power supply control means is constructed to retrieve the control signal from the information retrieval means on the basis of the determined current and voltage (page 3, line 25 - page 4, line 7). The electric current flowing

through the LED, combined with the measured voltage, is indicative of the temperature and resistance of the LED junction (Figure 2).

20. D3 shares a common purpose with the claimed invention. It relies on the forward bias voltage/current characteristic to provide an indication of the LED junction temperature during a measuring phase (D3, paragraph bridging pages 1 and 2; page 4, lines 7-20; Figure 2). It is a valid starting point on the basis of which the existence of inventive step may be assessed.
21. However, the claimed subject-matter differs from the lighting device known from D3 in more respects than recognised in the impugned decision.
22. The measuring means of D3 do not incorporate any additional measurement voltage source that is used to measure the current at a predetermined measuring voltage. It is stressed, in this respect, that the voltmeter 4 in Figure 1 of D3 cannot be equated with a voltage source, as the Examining Division held. As underlined in the statement of grounds, the current source 2 constitutes the only source of power available in the context of D3. There is also no mention, in D3, of any switching means for selectively connecting the LED to measuring means or to the adjustable power supply. In the context of D3, the measurement is carried out by appropriate control of the sole power supply, by reducing the voltage or current it delivers (Figure 2, page 4, lines 15-20).
23. A further difference between claimed subject-matter and the circuit of D3 is that the measuring voltage is smaller than the forward driving voltage of said LED and is such that it causes the current through the LED

which is less than half of the lowest driving current provided to the LED by the adjustable electrical power supply in the active mode. While D3 explicitly mentions a lower voltage or current during the measuring phase as compared to the active mode, it does not provide any concrete information as to how much lower.

24. By using a separate voltage source for measurement, which is designed for better performance when measuring, while the electrical power supply for driving the LED in active mode can be designed for better performance in that mode or for lower cost (cf. published application, page 4, lines 8-14), the claimed lighting device provides more precise measurements as to the voltage and current values and accordingly also as to the resistance or temperature values that are derived therefrom. As a result, the claimed lighting device allows a more precise control of the adjustable power supply in the active mode.
  
25. Moreover, the claimed device allows measurements at measuring voltages below the forward driving voltage of said LED, thus permitting the measurement of resistance or related quantities in the small-signal domain, that is, in conditions where self-heating of the junction is small, thus giving a high calibration accuracy without the need for high speed measurement circuitry (cf. published application, page 3, lines 27-34). A further effect appears to be that the resistance of the LED junction is much higher than in the active mode (page 3, lines 32-34), thus further contributing to more precise measurements, since the resistance to be measurement is proportionally increased compared to the other resistances in the measuring circuit.



26. The objective problem to be solved starting from document D3 consists thus in providing more accurate control of the lighting circuit.
27. D3 acknowledges that measurements carried out with high drive currents may lead to inaccurate results (cf. page 4, lines 11-20). In D3, the solution to this problem consists in temporarily adjusting the forward current or voltage to a lower level for the purpose of measurement. The solution envisaged in D3 relies on the same effect of limiting the self-heating of the diode junction as the claimed invention.
28. There is, however, no hint in D3 to further improve the accuracy of said measures by using separate measuring means comprising a non-adjustable voltage source of a higher precision than the adjustable power supply means and switching between said measuring means and adjustable power supply.
29. In the impugned decision, reference was made to D2, which was considered to disclose the claimed solution with switching between active and measurement modes with one LED array being switched off (see impugned decision, point 5.7).
30. While it is acknowledged that D2 shares a common purpose with the claimed invention in that it proposes to stabilise the output of a group of LED arrays by appropriate control of an adjustable power supply, it does not disclose or even hint at the claimed solution.
31. In order to stabilise both the intensity and colour temperature provided by a plurality of red, green and blue LED arrays, a control mechanism is provided in D2 that compensates for operating temperatures, age, and

manufacturing variations affecting the lighting device (page 2, lines 3-13).

32. The compensation process is carried out on the basis of measurements obtained from an optical sensor and a temperature sensor. The optical sensor (a photo-diode) delivers an indication of the light intensity resulting from the total light output generated by the three LED arrays and the ambient light. The temperature sensor includes a thermistor, or a thermopile, or any silicon-based sensor. It is configured to measure the case temperature on the basis of which the junction temperature of the LEDs is estimated (page 5, lines 4-11).
  
33. There is no suggestion in D2 to switch between an adjustable power supply and measuring means consisting of a voltage source and a current meter in combination in order to carry out precise measurements of the junction temperature (or resistance) of a LED. The passage referred to by the Examining Division on page 4, line 27 - page 5, line 3, merely describes how the optical sensor is controlled in order to measure the output of one single LED light source (red, green or blue). In a first step, the total output of light generated by the three light sources and ambient light is measured. In a second step, a LED source (in fact the LED array producing a certain colour) is switched off and the resulting total output is measured. It reflects the contribution of the two other Led arrays and ambient light. The difference between the two measurements is then calculated. It yields the light output from the LED light source array which is switched off.

34. The mere reference to some switching operation, in the passage referred above, is not sufficient to establish that the skilled person would have envisaged switching between two power sources.
35. As to the temperature measuring means of D2, not only do they not correspond to the definition of the measuring means in claim 1, but they also do not form part of a circuit that is switched on during the measurement phases, as required by the claim.
36. The Board cannot identify any hint in D2 suggesting that a more precise control can be achieved by providing measuring means as defined in claim 1.
37. While it is acknowledged that the skilled person in the field of diodes undoubtedly knows about switches, it is stressed that the claimed invention is not limited to the sole provision of switching means. General knowledge is not sufficient, in itself, to suggest that the objective problem of the invention can be solved by the provision of dedicated measuring means as defined in claim 1.
38. For these reasons, the subject-matter of claim 1 does not result in an obvious manner from the prior art. It is thus inventive in the sense of Article 56 EPC.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Examining Division with the order to grant a patent in the following version:

#### Description:

Pages 1 to 9 of the clean copy of the amended description filed during the oral proceedings of 11 March 2022.

#### Claims:

No. 1 to 5 of the clean copy filed during the oral proceedings of 11 March 2022.

#### Drawings:

Sheets 1/2 and 2/2 (Figs 1 to 4) as originally filed.

The Registrar:

The Chairman:



C. Moser

P. Scriven

Decision electronically authenticated