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**Datasheet for the decision
of 3 February 2020**

Case Number: T 1405/15 - 3.5.02

Application Number: 05852940.5

Publication Number: 1829430

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Language of the proceedings: EN

Title of invention:
Power supply for LED signal

Applicant:
GE Lighting Solutions, LLC

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - all requests (no)



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Case Number: T 1405/15 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 3 February 2020

Appellant: GE Lighting Solutions, LLC
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 3 March 2015
refusing European patent application No.
05852940.5 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Lord
Members: C.D. Vassoille
R. Cramer

Summary of Facts and Submissions

- I. The applicant (appellant) filed an appeal against the decision of the examining division to refuse European patent application no. 05 852 940.5, which is based on the international application published under the PCT as WO 2006/065569 A2.
- II. In the decision under appeal, the examining division *inter alia* came to the conclusion that the subject-matter of claim 1 of the main request as well as of the first and third auxiliary requests did not involve an inventive step in the sense of Article 56 EPC.
- III. With the statement of grounds of appeal of 3 July 2015, the appellant filed a new main request as well as new first and second auxiliary requests, these requests being based on the main request, first auxiliary request and third auxiliary request underlying the decision under appeal.
- IV. The following documents are relevant for the present decision:

D1: US 2003/234621 A
D2: GB 2 398 682 A
D3: EP 1 039 597 A2
D4: US 6 150 771 A
- V. In a communication under Article 15(1) RPBA, the board informed the appellant that it tended to share the examining division's opinion in the decision under appeal.
- VI. Oral proceedings before the board took place on 3 February 2020 in the absence of the appellant.

The appellant requested in writing that the decision under appeal be set aside and that a European patent be granted on the basis of the main request filed with the statement of grounds of appeal of 3 July 2015 or, if this was not possible, on the basis of one of the first and second auxiliary requests filed with the same letter.

VII. Claim 1 of the main request reads as follows:

"A power supply (14), comprising:
a component (110) for receiving input voltage;
a controller (190) that measures a RMS value of said input voltage and generates an analog signal that is proportional to said RMS value;
one or more LED strings (180);
a current regulator (230) that receives said analog signal and regulates the current flowing through each of said one or more LED strings (180) based on said analog signal; and
a current monitor (240) that compares an aggregation of the currents flowing through the one or more LED strings with a predetermined threshold and transmits a power supply termination signal when the aggregation of the currents is less than said predetermined threshold."

VIII. Claim 1 of the first auxiliary request reads as follows (underlining indicates additions with respect to claim 1 of the main request):

"A power supply (14), comprising:
a component (110) for receiving input voltage;

a controller (190) that measures a RMS value of said input voltage and generates an analog signal that is proportional to said RMS value;
one or more LED strings (180);
a current regulator (230) that receives said analog signal and regulates the current flowing through each of said one or more LED strings (180) based on said analog signal; and
a current monitor (240) that compares an aggregation of the currents flowing through the one or more LED strings with a predetermined threshold and transmits a power supply termination signal when the aggregation of the currents is less than said predetermined threshold;
wherein the current regulator (230) includes one or more voltage controlled current sources (VCCSs) in which each VCCS regulates current flowing through a different one of said LED strings."

IX. Claim 1 of the second auxiliary request reads as follows (underlining and strike through indicate amendments with respect to claim 1 of the main request):

"A traffic signal power supply (14), comprising:
a component (110) for receiving input voltage;
a controller (190) that measures a RMS value of said input voltage and generates an analog signal that is proportional to said RMS value;
~~one or more~~ a plurality of LED strings (180);
a current regulator (230) that receives said analog signal and regulates the current flowing through each of said ~~one or more~~ LED strings (180) based on said analog signal; and
a current monitor (240) that compares an aggregation of the currents flowing through the ~~one or more~~ LED strings with a predetermined threshold and transmits a

power supply termination signal when the aggregation of the currents is less than said predetermined threshold; wherein the current regulator (230) includes one or more voltage controlled current sources (VCCSs) in which each VCCS regulates current flowing through a different one of said LED strings; wherein each VCCS includes: an operational amplifier (op-amp) that receives said analog signal and said current flowing through said associated LED string; and a transistor that one of increases and decrease said current based on an output voltage of said op-amp."

- X. The appellant's arguments as far as they are relevant for the present decision were as follows:

Regarding the main request, the examining division considered that D1 discloses all of the features of claim 1 except the feature of the current monitor.

D1 however also did not disclose a controller measuring an RMS value of the input voltage and generating an analog signal that is proportional to the RMS value in the sense of claim 1.

Furthermore, there was no disclosure in D1 of the controller generating an analog signal that is proportional to the RMS value. The examining division wrongly interpreted the term "proportional" in the simple sense of "a relationship" between the analog signal and the RMS value, which was considered to be disclosed by figure 5 of D1. The normal meaning of the expression "proportional" was thus ignored, which correctly meant "corresponding in size or amount" or "having a constant ratio to another quantity".

D1 did not disclose a "proportional" relationship, since figure 5 was a graph of LED current against relative brightness, and thus no analog signal was generated that was proportional to the RMS value of the input voltage.

The subject-matter of claim 1 involved an inventive step in view of a combination of D1 and D4. The skilled person starting from D1 and seeking to improve the power supply would not consider document D4 because D1 and D4 were concerned with different problems and the skilled person looking to improve dimming control would not turn to a document that was not related to this issue, as is the case for D4.

Even if the skilled person would consider D4 there was no teaching or motivation in this document which would enable them to arrive at the present invention without the use of inventive skill.

Furthermore, D4 did not disclose all of the features of the current monitor recited in claim 1, in particular no power supply termination signal sent from the current monitor was disclosed. There was also no disclosure in D4 of a controller that measures an RMS value of an input voltage and generates an analog signal that is proportional to the RMS value.

Regarding the first auxiliary request, D1 did not disclose the new feature of claim 1 of "one or more voltage controlled current sources in which each voltage controlled current source regulates current flowing through a different one of said LED strings".

The skilled person starting from D1 would have no motivation to turn to D2, which was considered by the

examining division to represent the pertinent common general knowledge as regards the additional feature. This document related to LEDs typically used in illumination of display devices in automobiles such as liquid crystal displays and illumination of gauges in instrument panels and not to mimicking the operation of an incandescent bulb.

Regarding the second auxiliary request, D1 was not the closest prior art document, because claim 1 now recited "a traffic signal power supply" and consequently D4 was the closest prior art document.

D4 did not disclose at least a current regulator including a plurality of voltage controlled current sources (VCCS), each VCCS including an operational amplifier and a transistor as required by claim 1 and also did not disclose a termination signal sent from a current monitor. Furthermore, D4 also did not disclose a controller that measures an RMS value of an input voltage and generates an analog signal that is proportional to the RMS value.

Starting from D4, the skilled person would not combine this document with either D1 or D2, because it referred to a different problem than the other documents. Even if combining these documents, however, the skilled person would not arrive at the claimed invention.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 *Distinguishing features*

2.1.1 According to the examining division, the wording "RMS value of the power source" (or "input RMS power", see paragraph [0028] of DI) was just more general than the term "RMS value of voltage" but they all represented the same technical principle (see point 13 of the minutes of the oral proceedings posted on 2 March 2015). While the board shares the examining division's view that using the RMS input power or the RMS input voltage refers to the same technical principle, the board agrees with the appellant that measuring an RMS power value does not anticipate measuring of an RMS value of an input voltage in the sense of Article 54 EPC.

The board however considers this difference to be trivial for the skilled person, who would immediately recognise from D1 that the RMS value of the input voltage or of the input current may be used to calculate the RMS value of the input power.

2.1.2 From the minutes of the oral proceedings it is clear that the examining division has interpreted the term "proportional" as "a certain 'relationship' between the analog signal and the RMS value" (see point 13 of the minutes of the oral proceedings posted on 2 March 2015). The board does not recognise on what basis the examining division concluded, contrary to the term's clear technical meaning, that it had to be interpreted

"broadly" in the sense of a "certain relationship". The board therefore generally agrees with the appellant that the examining division's interpretation of the term "proportional" was incorrect.

In spite of the above finding, the board is not convinced by the appellant's arguments in this respect. First, also an exponential growth implies in principle the presence of a proportionality factor. Second, D1 discloses a section-wise linear function to mimic the dimming control of a conventional incandescent light. Therefore, contrary to what was argued by the appellant, D1 does not refer to the generation of an exponential signal as such. At least the linear sections are based on a signal generated by the controller, which is proportional to the measured RMS value.

2.1.3 Even if a further difference actually had to be recognised between the subject-matter of claim 1 and document D1, in particular that no proportional analog signal is generated in D1, but that only a certain (non-proportional) relationship between the analog signal and the RMS value existed, the board does not consider this difference to have any significance as regards the assessment of inventive step. In this respect the board notes in particular the proportional behaviour clearly indicated for LEDs in figure 2 of D1.

2.1.4 Furthermore, D1 clearly discloses a change in light intensity based on a feedback signal, which is modulated by the controller either by AM or PWM (see for example D1 in paragraph [0021]). Consequently, as far as the duty cycle in the context of PWM is controlled based on the measured RMS value, the generation of an analog signal must be involved, which

is reflected in a corresponding duty cycle. The decision under appeal is therefore correct in this point (see point 1.1 of the reasons for the decision under appeal).

2.1.5 Given the above considerations, the board has come to the conclusion that the nature of potential differences between the subject-matter of claim 1 and document D1, other than that established by the examining division in the decision under appeal, is such that they had to be considered as being trivial and therefore cannot contribute to an inventive step in the sense of Article 56 EPC.

2.1.6 The board concludes that the main difference between the subject-matter of claim 1 and D1 is that of the presence of a current monitor as defined in claim 1, as has been correctly found by the examining division in the decision under appeal (see point 1.2 of the reasons for the decision).

2.2 *Inventive step (article 56 EPC)*

2.2.1 The appellant did not contest that document D1 represents the closest prior art with respect to the subject-matter of claim 1 of the main request and the board also sees no reason to deviate from this finding of the examining division in the decision under appeal.

2.2.2 In the decision under appeal the examining division found that the subject-matter of claim 1 of the main request did not involve an inventive step in view of a combination of the closest prior art document D1 with document D4.

- 2.2.3 As concluded under point 2.1 above, the main distinguishing feature of claim 1 in view of D1 is the provision of a current monitor that compares an aggregation of the currents flowing through the one or more LED strings with a predetermined threshold and transmits a power supply termination signal when the aggregation of the currents is less than said predetermined threshold.
- 2.2.4 The appellant did not contest the objective technical problem formulated by the examining division of how to externally indicate a failure of LED strings (see point 1.3 of the reasons for the decision under appeal). The board therefore sees no reason to deviate from the objective technical problem as defined by the examining division.
- 2.2.5 D4 discloses in figures 10, 11A-11C and 12 in combination with the corresponding passages of the description in column 7, lines 46 to 53, a current monitor ("failure circuit 70") that compares an aggregation of the currents flowing through the one or more LED strings with a predetermined threshold and transmits a power supply termination signal ("the failure signal shorts a fuse 72") when the aggregation of the currents is less than said predetermined threshold ("If the output current drops by at least 50%").
- 2.2.6 In view of the objective technical problem, the skilled person would clearly have taken D4 into consideration when starting from D1 and being confronted with the objective technical problem of how to externally indicate a failure of the LED strings, as has been correctly found by the examining division.

D4 explicitly addresses not only the technical problem but also discloses the solution to this problem according to the distinguishing feature of claim 1. Additionally, like document D1, D4 is concerned with the question of how to replace conventional incandescent lamps with LEDs. Furthermore, the skilled person would not have been confronted with any difficulties when transferring the "failure circuit" of D4 to the power supply of D1 to thereby directly arrive at the claimed invention. Therefore, the appellant's arguments in this respect are not convincing.

It is further noted that claim 1 does not specify the use of a failure circuit in the absence of a switching circuit and the appellant's arguments in this regard are therefore irrelevant.

Furthermore, the "power supply termination signal" is not defined in any detail in claim 1 and it is therefore clear that also a signal sent from the current monitor to short the fuse must be considered as being a "power supply termination signal" in the sense of claim 1.

Given that the skilled person when starting from D1 and being confronted with the objective technical problem of how to externally indicate a failure of LED strings, would find the solution to this problem in D4, and would thus be prompted to implement the solution in D1 to thereby arrive at the subject-matter claim 1.

2.2.7 The board has therefore come to the conclusion that the subject-matter of claim 1 of the main request does not involve an inventive step in the sense of Article 56 EPC.

3. *First auxiliary request - inventive step (Article 56 EPC)*

3.1 The board cannot find any error in the assessment made by the examining division with regard to the inventive step of the subject-matter of claim 1 of the first auxiliary request.

3.2 The additional feature of claim 1 of the first auxiliary request refers to the current regulator including one or more voltage controlled current sources (VCCS) in which each VCCS regulates current flowing through a different one of said LED strings.

3.3 As has been found by the examining division in the decision under appeal, the problem of how to design the current regulator is entirely independent of the problem of how to externally indicate a failure of LED strings (see point 2.3 of the reasons for the decision under appeal).

The board's findings regarding the main request therefore in principle also apply to the first auxiliary request.

3.4 The examining division correctly found that the additional feature of claim 1 of the first auxiliary request is an obvious design choice, which is for example known from documents D2 and D3.

3.5 The appellant did not contest the fact that D2 as well as D3 discloses a current regulator including one or more voltage controlled current sources (VCCS) in which each VCCS regulates current flowing through a different one of a plurality of LED strings.

- 3.6 The appellant has however contested that the skilled person would have taken D2 into consideration, because this document was concerned with illuminating devices in the automobile industry and not with mimicking the operation of an incandescent lamp. The board is not convinced by this argument. Document D2 generally refers to light emitting diodes and addresses the problem of how to optimally control a plurality of LED strings. It is in particular not restricted to applications in the field of automobiles. The board does not consider it plausible that the skilled person would have limited their search to documents which are concerned with mimicking of incandescent lamps, when looking for solutions to the problem of how to design the current regulator.
- 3.7 The board has therefore come to the conclusion that the subject-matter of claim 1 of the first auxiliary request does not involve an inventive step in the sense of Article 56 EPC.
4. *Second auxiliary request - inventive step (article 56 EPC)*
- 4.1 The appellant's central argument regarding the second auxiliary request is that document D1, in view of the amended wording of claim 1: "traffic signal power supply" (emphasis added), is no longer the closest prior art document, but rather D4.
- 4.2 The board does not agree with this argument. Document D1 in paragraph [0009] mentions concrete applications of the LED light sources such as "runway lights, taxiway light, etc. at airports". Since claim 1 does not contain any substantial technical features that define the "traffic signal power supply" in more

detail, the appellant's arguments in this respect are not convincing and the power supply of D1 must be considered to be a "traffic signal power supply" in the sense of claim 1.

Document D1 is therefore the closest prior art with respect to the subject-matter of claim 1 of the second auxiliary request. The board's findings regarding the main request and the first auxiliary request thus apply correspondingly to the second auxiliary request.

- 4.3 The additional features of claim 1 refer to a design of the current regulator and thus to the same partial problem already addressed in the context of the first auxiliary request.

The additional features of claim 1 of the second auxiliary request are known from document D3, as has been correctly found by the examining division in the decision under appeal (see point 5.3 of the reasons for the decision). In particular, document D3 in figure 12 discloses one or more voltage controlled current sources (VCCSs) in which each VCCS regulates current flowing through a different one of said LED strings, wherein each VCCS includes an operational amplifier (OP1, ... OPm) that receives said analog signal and said current flowing through said associated LED string and a transistor (T1, ..., Tm) that either increases or decreases said current based on an output voltage of said op-amp.

Implementing a current regulator comprising corresponding features known from document D3 in the power supply of D1 is therefore considered by the board to be obvious.

It is further noted that the appellant did not file any observations regarding the examining division's reference to document D3 in the decision under appeal.

4.4 The board has therefore come to the conclusion that the subject-matter of claim 1 of the second auxiliary request does not involve an inventive step in the sense of Article 56 EPC.

5. *Conclusions*

Since the subject-matter of claim 1 of the main request as well as that of the first and second auxiliary requests does not involve an inventive step in the sense of Article 56 EPC, the appeal had to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

R. Lord

Decision electronically authenticated