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**Datasheet for the decision
of 9 May 2017**

Case Number: T 1203/12 - 3.5.02

Application Number: 03754619.9

Publication Number: 1547447

IPC: H05B33/08

Language of the proceedings: EN

Title of invention:
LED-BASED MODULAR LAMP

Patent Proprietor:
GE Lighting Solutions, LLC

Opponent:
Tridonic GmbH & Co KG

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
Novelty - (yes)
Inventive step - (yes)



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Case Number: T 1203/12 - 3.5.02

D E C I S I O N
of Technical Board of Appeal 3.5.02
of 9 May 2017

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
15 March 2012 concerning maintenance of the
European Patent No. 1547447 in amended form.**

Composition of the Board:

Chairman R. Cramer
Members: M. Léouffre
H. Bronold

Summary of Facts and Submissions

I. The opponent appealed against the interlocutory decision of the opposition division, posted on 15 March 2012, to maintain European patent No. 1 547 447 in amended form.

II. In the statement of grounds of appeal, which was received on 18 July 2012, the appellant referred mainly to documents:

E18 : US 6 414 801 B1;
E16 : DE 19 539 808 A1;
E7 : WO 00/17569 A1; and
E8 : US 6 400 104 B1.

The opponent objected that the subject-matter of claim 1 lacked novelty having regard to E18 and lacked inventive step in view of any of documents E18, E7, E16 or E8 taken alone, or in view of the combination of document E18 with either E16 or E7, or document E16 with any of documents E9 to E15:

E9 : US 5 688 042 A;
E10 : US 5 806 965 A;
E11 : US 5 921 660 A;
E12 : US 4 727 289 A;
E13 : DE 197 29 690 A1;
E14/D14 : US 5 463 280 A; and
E15 : WO 00/34709 A1.

III. In a communication under Article 15(1) RPBA sent together with summons to attend oral proceedings, the board had informed the parties that it had doubts as to whether the subject-matter of claim 1 lacked novelty over document E18 and whether it was rendered obvious by the discussed prior art documents.

- IV. Following the summons to oral proceedings and with a letter dated 8 February 2017, the appellant withdrew their request for oral proceedings and informed the board that they would not attend the scheduled oral proceedings.
- V. With a letter dated 7 April 2017, the patent proprietor (respondent) filed an auxiliary request.
- VI. Oral proceedings took place before the board on 9 May 2017 in the absence of the appellant.
- VII. The appellant had requested in writing that the decision under appeal be set aside and that European patent No. 1 547 447 B1 be revoked.
- VIII. The respondent requested that the appeal be dismissed (main request), or if that was not possible, that the patent be maintained on the basis of the claims of their first auxiliary request filed with letter dated 7 April 2017.
- IX. Claim 1 of the main request reads as follows:

"A lamp (10) comprising:

an optical module (12) comprising:

an LED module (20) including a plurality of LEDs (16) for emitting light and

a heat sink (22) thermally coupled to the LEDs (16) at one end of the heat sink to provide for removal of heat generated from the operating LEDs (16), the heat sink (22) having an electrical conduit (40) for transmitting conditioned electrical power to the LEDs (16) through the heat sink (22); and wherein the heat sink is connected to the LED

module at the one end and the lamp further comprises an electronics module (14) connected by a thermally conductive connection at an opposite end of the heat sink from the LED module (20) to form a unitary lamp with heat sinking of both the LED module (20) and the electronics module (14), the electronics module (14) including an input electrical interface (50) adapted to receive input electrical power and an output coupler (52) rigidly attaching to the optical module (12) for delivering conditioned electrical power to the LEDs (16) via the electrical conduit (40) of the heat sink (22), the electronics module (14) further including electrical conditioning circuitry for electrically coupling the input electrical interface to the output coupler (52)."

Claims 2 to 5 are dependent on claim 1.

X. The appellant's arguments as far as they are relevant for this decision can be summarised as follows:

Document E18 disclosed a lamp for a vehicle comprising first and second LED modules 40, 41, 80, 81 (see figures 2, 5 and column 8, lines 35 to 36, 60 to 61 and 66 to 67) and an electronics module comprising a circuit board 20 with a control circuit 21. The lamp also comprised a heat sink 30. The heat sink was made of metal to remove the heat from the LED module 40 (see column 5, lines 11 to 13 and 25 to 27). The LED module 40 was electrically connected to the circuit board with wires guided in an electrical conduit 50 (see column 6, lines 9 to 16 and 23 to 25). The circuit board 20 was received at one end of the heat sink and the LED module 40 at the opposite end, as recited in column 5, lines 9

to 11. The features related to the ends of the heat sink did not exclude that the heat sink enclosed the electronics module or the LEDs. The term "end" had to be understood as defining a region close to the end, and the term "received" in E18 as synonymous to "brought into position". The circuit board 20 with the control circuit 21, i.e the electronics module, was attached to the heat sink which removed the heat from the module.

Should the feature "an electronics module (14) connected by a thermally conductive connection at...the heat sink" be considered as novel having regard to E18, the subject-matter of claim 1 would still be obvious. Indeed in the event that the thermal connection between the circuit board and the heat sink were not good enough, a person skilled in the art would have improved it, for instance with a thermal interface material or compound. The subject-matter of claim 1 was therefore obvious in the light of E18 or in the light of the combination of E18 with E16, which disclosed electronics elements embedded in a thermal interface compound (see E16, column 3, lines 20 to 25).

The same reasoning was valid when starting from E7 which disclosed LEDs mounted on a polyhedron in the form of a substrate which was used as a heat sink for the LEDs (see page 4, lines 28 to 29). The polyhedron was connected to a gear column in which was placed the electronics module. Contrary to what was assumed in the contested decision under item 4.2, and since no wire "escaped" from the polyhedron and the column, an electrical conduit was necessarily provided between the electronics module and the LEDs situated on the polyhedron. A "conduit" had to be understood solely as a passage or an opening. The subject-matter of claim 1

differed from the disclosure of E7 solely in that there was a thermal connection between the electronics module in the gear column and the heat sink. For the same reason as for the vehicle lamp disclosed in E18, a person skilled in the art would have used a thermal interface compound to guide and improve the removal of the heat from the electronics module.

The subject-matter of claim 1 was also obvious having regard to E16 taken alone. As indicated in the contested decision, the subject-matter of claim 1 differed from the lamp known from E16 only in that LEDs were used rather than a low-voltage lamp. Without exercising an inventive step a person skilled in the art, aware of documents E9 to E15, would have adapted the electronics module to allow a replacement of the light bulb by one or a plurality of LEDs. The same was valid when starting from E8 (see figure 7), which disclosed a lamp comprising an electronics module 702 separated from an optical module by an air gap which had to be seen as a heat sink.

- XI. According to the patent proprietor (respondent) the subject-matter of claim 1 was novel having regard to E18 because the first support member 30 was a heat sink adapted to receive the circuit board 20 and the first board 40 supporting the LEDs such that the boards were positioned inside the heat sink 30 and surrounded by the heat sink 30, away from the ends (see column 8, line 37, and column 5, lines 9 and 10). Column 5, lines 10 to 12 of E18 recited that the circuit board and the first board were received at both ends, which did not mean connected to both ends.
- Furthermore, E18 did not mention any thermal connection between the circuit board 20 and the heat sink. Not all circuit boards were thermally conductive. E18 only

mentioned at column 8, lines 29 to 31 that the circuit board was secured to the heat sink 30, seated on a ridge 31. While according to column 5, lines 25 to 28 the LEDs were glued to the first heat sink using thermally conductive adhesive, E18 did not give any information about a thermal connection between the heat sink 30 or its ridge 31 and the circuit board 20. This was confirmed by the passage at column 3, lines 45 to 47 which recited "the first and second support members also function as heat sinks so as to absorb and remove the heat generated by the LEDs", whereby no heat generated by the circuit board was mentioned. No reference to the circuit board 20 was found in figure 6 of E18 either. Assuming the outermost plate shown in figure 6 was the circuit board, it had to be concluded that the circuit board was positioned in the middle of the heat sink 30 close to the LEDs and not at an end of it.

A person skilled in the art would also not have found any incentive in E18 to cool the circuit board. If he had, he would have placed some heat-conductive adhesive on top of the circuit board. Nevertheless, the person skilled in the art would not have arrived thereby at the subject-matter of claim 1, because the circuit board 20 and the LEDs would have remained positioned in the middle of the heat sink, close to each other, not remote from each other at opposite ends of the heat sink. This theoretical solution would have led the heat generated by the LEDs and the circuit board to the same area of the heat sink. The heat sink would then have been less efficient than the one claimed, wherein the heat generated by the electronic module and the LEDs was transmitted to the heat sink at opposite ends of it. The person skilled in the art would not have found in E18 any incentive to simplify the assembly of the device shown in E18 either.

Furthermore, the application of the teaching from E16 to E18 would also have corresponded to a reverse development of the technology since the LED technology was a more modern technology than the one described in E16.

Considering E16 as a starting point, the subject-matter of claim 1 differed therefrom in that

- LEDs were used, which were thermally coupled with a heat sink at one end of the heat sink,
- an electrical conduit for transmitting conditioned electrical power to the LEDs through the heat sink was provided, and
- the electronics module was connected by a thermally conductive connection at an opposite end of the heat sink from the LED module.

In E16 the heat was transmitted from the bulb 3a to the middle of the heat sink 2 via the socket 5. No electrical conduit was mentioned, and the circuit board 6 was not defined as being in thermal connection with the heat sink 2, not even via the housing 1, which might even have been insulating. The circuit board of E16 could therefore not be seen as being connected by a thermally conductive connection at an opposite end of the heat sink. Even if it were seen as being connected by a thermally conductive connection to the heat sink 2, the heat generated by the circuit board 6 and the bulb 3a would have been led to the same area of the heat sink, and not at opposite ends as mentioned in claim 1 of the patent in suit.

The subject-matter of claim 1 was therefore not obvious having regard to E18 or E16 taken alone or in combination.

E7 did not disclose any conduit provided between the substrate acting as heat sink and the electronics module inside the gear column. Connections between the LEDs supporting substrate and the electronics module were likely tracks on the surface of the substrate 3. Furthermore, E7 cooled the electronics module using a fan as an active cooling (see page 5, lines 6 to 12 of E7). There was no reliance in E7 on the substrate 3 for cooling the electronics module in the gear column. The subject-matter of claim 1 was therefore not obvious starting from E7.

In E8 the assembly 702, 706 provided heat shielding for the electronics contained within the housing 702 from the heat generated by the fluorescent tube 708 (see column 4, lines 41 to 44). Furthermore an air gap, which was inherently thermally resistive, was interposed between the housing 702 comprising the electronics module and the support member 706 of the fluorescent tube. The disclosure of E8 was therefore remote from the present invention.

Reasons for the Decision

1. The appeal is admissible.
2. Novelty (Article 54 EPC)
 - 2.1 E18 discloses a lamp in the form of a light assembly using light emitting diodes (see column 3, lines 28 and 29).

The lamp comprises an optical module comprising an LED module 40 including a plurality of LEDs 41 for emitting light and a first support member 30 acting as a heat sink (cf. column 5, lines 11 and 12 and column 8, lines

29 to 40) thermally coupled to the LEDs to provide for removal of heat generated from the operating LEDs (see column 5, lines 25 to 28). The heat sink 30 has an electrical conduit 50 for transmitting conditioned electrical power to the LEDs 41 through the heat sink 30 (see column 6, lines 13 to 15 and column 8, lines 40 to 42).

The lamp further comprises a circuit board 20 for delivering conditioned electrical power to the LEDs 41 via the electrical conduit 50 of the heat sink 30.

- 2.2 The term "end" should be given its general meaning which is an area comprising the front surface (of the heat sink) but not limited to the front surface. Nevertheless, the area should not be seen as ranging up to 50% of the length of the heat sink. Column 5, lines 10 and 12 of E18 recites that the circuit board 20 and the first board (reference 40 in figure 6) are "received" at both ends of the support member which acts as a heat sink". There is no explicit disclosure that the circuit board 20 and the first board 40 are at the opposite ends of the first support member acting as the heat sink.

While the expression "received at one end" might sometimes mean "disposed at one end" the board agrees with the patent proprietor that the term "received" is not a synonym for "connected to". In the context of E18 in particular figure 6, which discloses a heat sink comprising a top portion 32 (see column 8, lines 56 to 59) and a plate (which can only be interpreted as representing the circuit board 20) positioned inside and in the middle of the heat sink 30, the term "received" should be interpreted as meaning introduced

by an end (end of portion 32) of the heat sink opposite the end where the LEDs are positioned.

2.3 There is also no explicit disclosure of a thermally conductive connection between the circuit board 20 and the heat sink 30.

2.3.1 The circuit board 20 of E18 can be seen as comprising implicitly an input electrical interface adapted to receive input electrical power. It does not however comprise an output coupler rigidly attached to the optical module and an electronics module including electrical conditioning circuitry for electrically coupling the input electrical interface to the output coupler. E18 recites at column 8, lines 31 to 35 that "control components 21 consist of circuitry, including but not limited to diodes and resistors, and serve to allow two intensities of light and are operably connected to by means of wires to the circuit board 20 and actuation devices in the interior of the vehicle". Thus the electronic conditioning circuitry is understood as being positioned outside the lamp and linked to the circuit board by wires whereby the circuit board does not comprise any output coupler rigidly attached to the optical module. It follows that the board shares the opinion of the respondent-proprietor that the circuit board does not generate such an amount of heat that it would need to be in thermally conductive connection with the heat sink.

2.4 Thus the subject-matter of claim 1 differs from the lamp disclosed in E18 by

- a heat sink thermally coupled and connected to the LEDs and LED module at one end of the heat sink;
- an electronics module connected by a thermally conductive connection at an opposite end of the

heat sink from the LED module to form a unitary lamp with heat sinking of both the LED module (20) and the electronics module; and

- an electronics module including an input electrical interface adapted to receive input electrical power and an output coupler rigidly attached to the optical module, and further including electrical conditioning circuitry for electrically coupling the input electrical interface to the output coupler.

The subject-matter of claim 1 is therefore new within the meaning of Article 54 EPC.

3. Inventive step (Article 56 EPC)

3.1 With respect to E18

Document E18 is considered as representing the closest prior art. As mentioned under item 2.4 above, the circuit board 20 of E18 does not comprise an electronics module and does not therefore generate heat, such that it would need cooling. Thus, there is no need for a person skilled in the art to move the circuit board to another position e.g. to an end of the heat sink, to improve the heat removal, or to provide a thermal connection between the circuit board and the heat sink 30 with e.g. a thermally conductive compound, as is conventionally done in E16. The subject-matter of claim 1 is therefore not obvious having regard to E18 taken alone or the combination of E18 with E16.

3.2 With respect to E7

E7 discloses a lamp comprising an optical module comprising a plurality of LEDs 4 mounted on a substrate

acting as a heat sink 3 (see figures 1 and 2), connected and thermally coupled to the LEDs to provide for removal of heat generated from the operating LEDs (see page 3, lines 15 to 18 and page 4, lines 28 to 30). The lamp comprises also an electronics module inside the gear column 1 (see page 3, lines 32 and 33). The electronics module includes an input electrical interface adapted to receive input electrical power (cap 2 in figures 2 and 3) including electrical conditioning circuitry for electrically coupling the input electrical interface to the LED module. The LEDs and the electronics module are cooled by an air flow generated by a fan incorporated in the gear column (see page 5, lines 7 and 8).

- 3.2.1 E7 does not disclose that
- the electronics module is connected by a thermally conductive connection to the heat sink 1;
 - the heat sink 1 has an electrical conduit for transmitting conditioned electrical power to the LEDs through the heat sink;
 - the electronics module is connected at an opposite end of the heat sink 1 (with respect to the LED module), and
 - the electronics module includes an output coupler rigidly attached to the optical module for delivering conditioned electrical power to the LEDs via the electrical conduit of the heat sink.

3.2.2 The board agrees with the appellant that a person skilled in the art could thermally connect the electronics module with the heat sink constituted by the gear column 1 to enhance the removal of heat. There is however no incentive for a person skilled in the art to provide the electronics module with a coupler and to change the position of the electronics module to

position it at the opposite end of the heat sink with respect to the LEDs. He would therefore not arrive at a lamp according to claim 1.

3.3 With respect to E8

The appellant seems to consider the air gap between the electronics module 702 and the optical module 706 as a heat sink (see grounds of appeal at page 11, 4th paragraph). However, the board shares the opinion of the patent proprietor that an air gap is rather resistive to the transmission of thermal power. This is confirmed in E8 at column 5, lines 1 to 4, according to which "the air gap 734 is provided between the support member 706 and the housing 702 to reduce the transfer of heat from the lamp tubes to the interior of the housing". Hence the air gap cannot be seen as a heat sink in the sense of the invention.

The disclosure of E8 is therefore considered to be remote from the present invention.

3.4 With respect to E16

E16 discloses a lamp comprising a halogen light bulb 3 and a heat sink 2 thermally coupled to the light bulb 3 to provide for removal of heat generated from the light bulb 3 (see column 3, lines 48 to 51).

The lamp further comprises a control circuit 6 connected by a thermally conductive connection to the housing 1 (see column 3, lines 20 to 25). The thermally conductive resin inserted between the control circuit 6 and the housing 1 helps to lead away the heat generated by the control circuit 6.

The control circuit 6 together with the input electrical interface 4 and the socket 5 (output coupler) constitutes an electronics module which delivers conditioned electrical power to the light bulb 3.

Rather than an electrical conduit, E16 uses the socket 5 of the electronics module, which corresponds to the output coupler of the present invention, to attach separately the light bulb 3 and the heat sink 2 (see column 3, lines 43 to 48).

E16 does not disclose that the electronics module 1, 6 is connected by a thermally conductive connection to the heat sink 2 to form a unitary lamp with heat sinking of both the optical module and the electronics module.

- 3.4.1 Thus the subject-matter of claim 1 differs from the device shown in E16 in that
- the lamp comprises an LED module including a plurality of LEDs;
 - the LEDs and the heat sink constitute an optical module to which the electronics module is rigidly attached;
 - the heat sink has an electrical conduit for transmitting conditioned electrical power from the electronics module to the optical module through the heat sink;
 - the optical module and the electronics module are thermally coupled at opposite ends of the heat sink.
- 3.4.2 The board agrees with the appellant that a person skilled in the art could use the housing 1 of E16 to

lead the heat generated by the control circuit 6 to the heat sink 2, and that a halogen lamp could be replaced by an LED lamp if the electronics module were suitably adapted.

Nevertheless, the heat generated by the electronics module and the LEDs would still be transmitted to the same side of the heat sink and not to opposite ends of the heat sink as claimed, whereby hot spots would not be avoided.

A person skilled in the art would also not find any incentive to modify the structure of the lamp of E16 to create with the LED-module and its heat sink an optical module, to which the electronics module would be rigidly attached. This feature allows for the construction of a modular lamp wherein the optical module can be powered by various types of electrical inputs including different types of electrical connectors by selecting an appropriate electronics module (see paragraph [0037] of the published patent). The subject-matter of claim 1 therefore involves an inventive step having regard to E16.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

R. Cramer

Decision electronically authenticated