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D E C I S I O N
of 11 January 2006

Case Number: T 0759/04 - 3.4.03

Application Number: 97912314.8

Publication Number: 0938834

IPC: H05B 33/08

Language of the proceedings: EN

Title of invention:

Lamp

Applicant:

L.F.D. Limited

Opponent:

OXLEY DEVELOPMENTS CO., LTD.

Headword:

-

Relevant legal provisions:

EPC Art. 123(2), 56

Keyword:

"Inventive step (no)"

"Requests filed towards the end of oral proceedings must be clearly allowable"

Decisions cited:

T 0270/90

Catchword:

-



Case Number: T 0759/04 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 11 January 2006

Appellant: OXLEY DEVELOPMENTS CO., LTD.
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
6 May 2004 concerning maintenance of European
patent No. 0938834 in amended form.

Composition of the Board:

Chairman: R. G. O'Connell
Members: V. L. P. Frank
T. Bokor

Summary of Facts and Submissions

- I. These are appeals by the proprietor and the opponent respectively against the interlocutory decision to maintain European patent 938 834 in amended form (Article 102(3) EPC).
- II. Claim 1 of the granted patent forming the basis of the appellant proprietor's main request is worded as follows:
- "1. A lamp for an external warning light comprising a body (101) providing a drive terminal (102, 103) and a return terminal (102, 103), a series/parallel array (170) of a plurality of visible light, light emitting diodes (VL LEDs) (107) arranged on a carrier (106) mounted on the body and a current limiting device (123) mounted within the body for limiting current drawn by the VL LEDs, the current limiting device (123) being connected in series with the array of VL LEDs (170), with the array and the current limiting device being connected between the drive terminal(102, 103) and the return terminal (102, 103);
characterised in that the current limiting device is an integrated circuit device (123) in series with the VL LEDs (107), adapted to limit forward current through them when their resistance falls on heating in use."

Claim 1 of the 1st auxiliary request has the following wording:

"1. A lamp for an external warning light comprising:
a body (101) providing a drive terminal (102, 103)
and a return terminal (102, 103),
a carrier (106) connected to the body,
a series array (170) of a plurality of visible
light, light emitting diodes (VL LEDs) (107)
arranged on the carrier (106), and
a current limiting device (123) connected in
series with the array of VL LEDs (170) for
limiting current drawn by the VL LEDs,

characterised in that:

the array of VL LEDs (107) is a series/parallel
array (170); in that
the carrier (106) is mounted on the body; in that
the lamp is adapted to be driven by application of
direct current to the terminals; in that
the current limiting device (123) is:

mounted within the body (101) and is
connected together with the array (170) in
direct series between the drive terminal
(102, 103) and the return terminal (102,
103); and in that

the current limiting device is an integrated
circuit device (123), adapted to limit forward
current through the VL LEDs (107) when their
resistance falls on heating in use; in that
the carrier comprises a ceramic substrate (106) on
which the VL LED array (170) is mounted; in that
the body is a tubular metal body; and in that
the ceramic substrate is mounted on a metal heat
sink."

Claim 1 of the 2nd auxiliary request adds the following feature to claim 1 of the 1st auxiliary request after the feature specifying that the current limiting device is an integrated circuit device:

"the VL LEDs are covered by a common layer of transparent potting material (109), the material being continuous and in contact with the carrier between some of the VL LEDs; in that"

The set of claims of the main, 1st and 2nd auxiliary requests comprise further an independent claim directed to a lamp for an external warning light comprising visible and infrared LEDs, and an independent claim directed to an aircraft lighting circuit for operating one or more lamps according to the previous claims.

The 3rd auxiliary request, which was submitted towards the end of the oral proceedings, is identical to the 2nd auxiliary request except that independent claim 1 and the claims depending on it were deleted. This request comprises therefore the two independent claims mentioned in the preceding paragraph.

III. The following prior art documents *inter alia* were cited in the opposition procedure:

D3: FR 2 586 844 A

D11: US 5 278 432 A

D19: US 5 495 147 A

D24: GB 1 490 978 A

- IV. The opposition division maintained the patent on the basis of claim 1 of the present 2nd auxiliary request, as it considered that the mounting of the integrated circuit device within the lamp's tubular metal body contributed to dissipating the heat generated by the VL LEDs. Moreover, the use of a ceramic substrate and the common potting of the LEDs made the lamp specifically adapted as a filament bulb replacement for use in harsh environments such as those encountered in the aircraft industry.
- V. At the start of the oral proceedings before the board the appellant proprietor requested that his main, 1st and 2nd auxiliary requests be amended so that claim 1 be directed to "a lamp for an **aircraft** external warning light" instead of "a lamp for an external warning light". The amended requests were admitted by the board, but subsequently found to contravene Article 123(2) EPC. The appellant proprietor therefore reverted to the requests mentioned under point II.
- VI. The appellant opponent argued essentially as follows:
- The amendment made to claim 1 of the main, 1st and 2nd auxiliary request, ie claiming "a lamp for an **aircraft** external warning light", was an undisclosed intermediate generalization, as the patent application disclosed exclusively either a lamp for an external warning light or for an aircraft navigation light.

- Document D3 disclosed the preamble of claim 1 of the main request. The use of an integrated circuit for limiting the current through an array of LEDs, ie the characterising part of this claim, was however known *inter alia* from document D19. The claimed lamp consequently did not involve an inventive step.

- The expression "in direct series" employed in the 1st and 2nd auxiliary requests with respect to the connection of the current limiting device was not disclosed in the patent if this expression was interpreted to mean that nothing else was connected inbetween, as the embodiment shown in Fig. 5 comprised resistors 121 and 122 connected between the integrated circuit 123, the array of LEDs 170 and the terminals of the lamp.

- Claim 1 of the 1st auxiliary request specified further to the features of claim 1 of the main request that the lamp was driven by direct current, that the current limiting device was connected in "direct series", that the LEDs were mounted on a ceramic substrate, that the lamp's body was a tubular metal body and that the ceramic substrate was mounted on a metal heat sink. Claim 1 of the 2nd auxiliary request specified further that the LEDs were covered by a common layer of a transparent potting material. These features addressed different problems, namely to use the lamp with direct instead of alternating current, to prevent the thermal runaway of the LEDs and to increase the mechanical stability of the lamp. These features were however disclosed for the same

purposes in the prior art (cf eg D11, D19 and D24). The lamp according to these requests therefore did not involve an inventive step.

- It was requested that the 3rd auxiliary request be not admitted due to its late filing at the end of the oral proceedings. The criteria usually applied for admitting a request at such a late stage of the proceedings was that it should be clearly allowable. The 3rd auxiliary request did not satisfy this criterion.

VII. The appellant proprietor argued essentially as follows:

- It was disputed that the amendment to the main, 1st and 2nd auxiliary requests extended beyond the content of the original application. The red and green (ie port and starboard) navigation lights of the aircraft were replaced by infrared lights during covert flying. The lamps were therefore no longer navigation but aircraft warning lights.
- The patent provided an incandescent filament bulb replacement lamp for use in an aircraft. To achieve sufficient luminosity the LEDs had to be packed tightly. The heat produced by them had to be removed so that thermal runaway of the LEDs could be prevented. Document D3 related to a signalling light and would not have been considered by the skilled person as a suitable starting point for designing an aircraft's external lamp, since the lamp of D3 was far too bulky for this use. Moreover, in this document

only resistors but no integrated circuits were used as current limiting devices.

- The lamp according to the 1st auxiliary request addressed further the problem of removing the heat produced by the densely packed LEDs. To this effect the LEDs were mounted on a ceramic substrate/metal heat sink complex and thermally connected to the lamp's tubular metal body so that the generated heat could be dissipated through the aircraft's body. There were no suggestions in the prior art to do such a thing or to place the integrated circuit within the lamp's body

- The expression connected in "direct series" was intended to clarify the difference over the lamp disclosed in document D3 in which a diode rectifying bridge was employed. Under alternating voltage the current traverses for each half cycle a different branch of the bridge. In contrast under direct voltage, as in the patent, the current always traverses the same circuit branch.

- Claim 1 of the 2nd auxiliary request specified further the use of a transparent potting material to cover the LEDs. Document D24 disclosing such a use dated from 1973, ie the early life of LEDs. However, document D3, dating from 1985, did not use potting material but individual LEDs. This showed that the common potting of the LEDs had been abandoned in the art. As shown in Fig. 4 of the patent individual LED chips instead of finished LEDs were employed for increasing the packing density and light output. Moreover D24 did

not disclose bonding one LED chip to the next as done in the patent. The LED array and the LEDs disclosed in this document were different from the ones of the patent. On the other hand, although document D11 disclosed common potting and bonding of the LEDs, it was directed to a lamp for a light box with little luminosity and not to a lamp for an aircraft.

- It had to be emphasized that the patent disclosed a lamp for the specific use in avionics. This was an extremely harsh environment subjected to extremes in pressure and temperature and to strong mechanical vibrations. The skilled person would not have considered lamps either for light boxes or traffic lights as starting point for designing a replacement lamp for an aircraft.

- As the board appeared inclined not to accept the presence of an inventive step in the subject-matter of claim 1 of the main, 1st and 2nd auxiliary requests, a 3rd auxiliary request was submitted from which claim 1 and the claims depending on it had been deleted.

VIII. At the oral proceedings before the board the appellant proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of:

- claims 1 to 19 filed as main request with letter of 9 December 2005, or

- claims 1 to 22 filed as 1st auxiliary request with letter of 9 December 2005, or
- claims 1 to 20 filed as 2nd auxiliary request with letter of 9 December 2005, or
- claims 8 to 20 filed as 3rd auxiliary request during oral proceedings.

The appellant opponent requested that the decision under appeal be set aside and that the patent be revoked.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments (Article 123(2) EPC)*
 - 2.1 At the start of the oral proceedings, the appellant proprietor requested permission to amend the main, 1st and 2nd auxiliary requests by introducing the term "aircraft" so that claim 1 would be directed to "A lamp for an **aircraft external warning light**".
 - 2.2 The patent application discloses either a lamp for an **external warning light** (cf page 1, lines 3 and 18 to 19 of the published application) or a lamp for an **aircraft navigation light** (cf *ibid*, page 1, lines 4 and 7; page 5, lines 1 and 5; page 9, line 6). However, a lamp for an aircraft external warning light is not explicitly disclosed therein.

- 2.3 The board considers that at the time of drafting the application the inventor considered the use of the lamp for an external warning light without any restrictions as to where the lamp was mounted. This includes a multitude of possible uses and is not restricted to avionics. On the other hand, the disclosed use in the field of avionics was solely as navigation lights.
- 2.4 Navigation lights allow determining not only the position of the aircraft, but also, if coloured visible lights are used, to determine whether the aircraft is approaching or receding from the observer. Although navigation lights may be considered warning lights, the converse is not true, ie not all warning lights serve navigation purposes.
- 2.5 Although the patent application discloses lamps combining visible (VL) and infrared (IR) LEDs, switching between the VL and IR LEDs does not transform the navigation lights into warning lights, contrary to the appellant proprietor's representative arguments during the oral proceedings, since they still serve to determine the position of the aircraft, ie a navigation purpose. This understanding corresponds to the disclosure in the application which states that the "aircrafts navigation lights can be switched from normal to covert simply by reversing the polarity of the voltage supplied to them. Where visible navigation lights only are required,..., the IR LEDs can be omitted from the lamp." (cf *ibid*, page5, lines 1 to 6). It is therefore clearly stated in the application that the lamps remain navigation lights even if switched to the covert (IR) mode.

- 2.6 Warning lights merely serve to warn. External warning lights in an aircraft call attention to something to be taken care off (eg during servicing the aircraft while landed). Such lamps are however neither explicitly disclosed in nor are they directly and unambiguously derivable from the application.
- 2.7 The amendment proposed to be made to claim 1 of the main, 1st and 2nd auxiliary requests is, for these reasons, an undisclosed intermediate generalization which does not comply with Article 123(2) EPC and is therefore not a permissible amendment.
3. The appellant proprietor therefore reverted back to his previous main, 1st and 2nd auxiliary requests. Claim 1 according to these requests is reproduced at point II above.
4. *Main request - Inventive step - (Article 56 EPC)*
- 4.1 Document D3 discloses a signalling lamp using LEDs as light source which is applicable, in particular, to traffic lights (cf page 1, 1st paragraph). The LEDs are arranged in a series/parallel array and current limiting resistors 16, 17 are connected in series with them (cf Figure 3 and page 5, lines 31 to 37).
- 4.2 The appellant proprietor argued that document D3 was not a reasonable starting point for assessing the inventive step of the opposed patent, since the lamp disclosed therein was for a traffic signalling light while the patent discloses an incandescent bulb replacement lamp for an aircraft, ie a completely different use in a very different environment.

However, claim 1 is directed to an external warning light and, as already mentioned, is not restricted to an aircraft's navigation light. Document D3 discloses a traffic signalling light, ie something that, in the board's view, can be regarded as an external warning light falling under the wording of claim 1.

- 4.3 The appellant proprietor has further disputed that this document discloses that the LEDs are mounted on a carrier which is mounted on the body of the lamp and that the current limiting device is mounted within this body. In document D3 the body of the lamp is formed by the cylindrical housing 22 and the screw cap 26 and the current limiting device and the LEDs are both mounted within this body (cf Fig. 4 and page 6, lines 11 to 24).
- 4.4 The lamp according to claim 1 differs therefore from the lamp disclosed in document D3 in that the array of LEDs is mounted on the lamp's body and in that an integrated circuit is used as current limiting device.
- 4.5 The opposed patent however does not disclose any technical effect associated with mounting the LEDs on the body of the lamp and the appellant proprietor has also not argued in this sense. The board considers therefore this difference merely as a design option to which no technical significance is attached.
- 4.6 The problem of thermal runaway of LEDs was well known in the art before the priority date of the opposed patent. The resistance of LEDs decreases when they warm up and, if not prevented, more current is drawn from a constant voltage source as the resistance falls. This

causes further heating up of the LEDs, reducing further their resistance. In the end this thermal runaway destroys the LEDs.

Document D19 discloses the use of an integrated circuit as current limiting device in a lamp of LEDs, preventing this self-destructing thermal runaway. The "series resistor" is replaced by an IC which supplies constant current and voltage. Incidentally, the specific IC disclosed in D19 is also the IC mentioned in the opposed patent (cf D19, column 3, lines 46 to 54 and the opposed patent, column 5, lines 1 to 2).

4.7 The board considers therefore that the lamp of claim 1 does not involve an inventive step within the meaning of Article 56 EPC, since the skilled person would have replaced the series resistor employed in document D3 by the IC disclosed in document D19.

5. *1st and 2nd auxiliary request - "Connected in direct series"*

5.1 Claim 1 according to these requests states that the integrated circuit (IC) is connected with the LED array in "direct series" between both terminals of the lamp.

5.2 The expression "connected ... in direct series" could be interpreted as meaning directly connected in series, ie, as pointed out by the appellant opponent, that nothing else is connected between them. However, such a connection is not disclosed in the patent application. While the circuit shown in Figure 2 discloses a current limiting element 12 directly connected between the terminals and the LEDs array 70, this element is a

resistor and not an IC (cf the patent application, page 4, lines 13 to 17). The circuit shown in Figure 5, on the other hand, discloses an IC 123 as current limiting device. However, this embodiment also comprises two forward voltage regulation resistors 121 and 122 connected between the IC and the LEDs (cf *ibid*, page 6, lines 11 to 15).

Consequently, with this interpretation of "direct series", claim 1 contravenes Article 123(2) EPC.

- 5.3 The appellant proprietor advanced another interpretation of this expression during the oral proceedings. In his view, this expression should be interpreted as delimiting the claimed lamp with respect to the lamp disclosed in document D3, in which an LED signalling lamp used with alternating current (AC) is disclosed. To drive the LEDs by direct current (DC) a rectifying diode bridge is connected between the terminals of the lamp. Accordingly, the "direct series" connection should limit the connection of the lamp only to DC.
- 5.4 The board is however of the view that such a limitation cannot be discerned in the expression "connected in ... direct series" nor is this interpretation suggested by the patent specification. It follows therefore that claim 1 is neither clear nor supported by the description as required by Article 84 EPC.
- 5.5 Already this deficiency in the claims would be sufficient for the 1st and 2nd auxiliary request to be refused, nevertheless, the board will in the following also address the issue of inventive step.

6. *1st and 2nd auxiliary request - Inventive step*

6.1 Claim 1 of the 2nd auxiliary request specifies further to the features of claim 1 of the 1st auxiliary request that the LEDs are covered by a common transparent potting material. In the following claim 1 of the 2nd auxiliary request will be addressed. However, this discussion applies with equal force to claim 1 of the 1st auxiliary request.

6.2 The lamp according to claim 1 of the 2nd auxiliary request differs from the lamp disclosed in document D3 essentially by the following features:

- (a) the lamp is adapted to be driven by application of DC,
- (b) the current limiting device is an IC device,
- (c) the IC is connected in direct series to the LEDs,
- (d) the LEDs are covered by a common layer of a transparent potting material which contacts the carrier between some of the LEDs,
- (e) the LED's carrier comprises a ceramic substrate,
- (f) the carrier is mounted on a metal heat sink, and
- (g) the body of the lamp is a tubular metal body.

6.3 The board shares the view of the appellant opponent that the lamp disclosed in document D3 is adapted to be

driven by DC, ie feature (a). Although this conventional lamp has a rectifying diode bridge 11 at the terminal ends of the circuit, this bridge does not prevent the lamp being driven by DC (cf Fig. 2). In any event it is obvious to the skilled person that a rectifying bridge is not needed when the lamp is driven by DC instead of AC. No inventive step can be involved in removing an obviously unnecessary feature.

6.4 As mentioned already at point 4.6 when discussing claim 1 of the main request, feature (b), ie the use of an IC as current limiting device in a lamp of LEDs, is disclosed in document D19.

6.5 As mentioned in point 5, no specific meaning can be attributed to the expression "connected in direct series". Consequently, feature (c) does not contribute to the assessment of inventive step.

6.6 Document D11 discloses that by using individual LED chips instead of finished, discrete LEDs the light output of a lamp can be increased, as the chips may be packed more closely together. However, the larger amount of heat produced has to be safely removed. To this effect it discloses an LED array lamp comprising a ceramic layer 16 on a metal heat sink 12 on which arrays of individual LED chips 14 are mounted. The metal heat sink 36 is connected to the body of the lamp 28 (cf Abstract; column 1, lines 44 to 51; column 1, line 65 to column 2, line 10; column 2, lines 34 to 56; Figures 1 and 5). The array of LEDs is covered with a coating of a transparent epoxy material, ie a transparent potting material, to protect it during handling (cf column 2, lines 26 to 29).

- 6.7 There is obviously the need specially to protect the LED chips used in D11, as they are much more sensitive to environmental damage than the encapsulated, discrete LED devices used eg in D3. It is moreover implicitly disclosed in this document that the epoxy material contacts the ceramic material between these LED chips. It follows that features (d), (e) and (f) are disclosed in document D11.
- 6.8 Although document D11 relates to a LED lamp for providing light to enhance and test plant growth and not to an external warning light as the opposed patent does, the skilled person would not, in the view of the board, have ignored its disclosure. Once the skilled person chooses to use LEDs as a high intensity light source he consults the prior art documents relating to this kind of light source that are concerned with increasing the light output. Document D11 addresses in particular how to achieve sufficient light output from a small radiant area. This issue has obvious relevance to the design of a warning light.
- 6.9 Feature (g), ie that the body of the lamp is a tubular metal body, is a must in a retrofitting lamp which has to have the same overall shape of the incandescent lamp which it is intended to replace. This is for example the case with the lamp disclosed in document D3 in which the lower caps 7 or 8 have different shapes depending on the sockets they have to fit in (cf Fig. 2).

- 6.10 The lamp of claim 1 addresses therefore the problem of providing in a retrofitting lamp a higher light output while preventing its thermal destruction. This is achieved by improving the current limiting device, ie replacing the passive resistor of document D3 by the integrated circuit disclosed in document D19, and by a higher packing density of the LEDs and removal of the generated heat by the means disclosed in document D11.
- 6.11 The appellant proprietor has argued that the lamp of claim 1 allows the removal of the heat produced by the LEDs through the metal heat sink to the body of the lamp and from there to the aircraft. The board is not persuaded by this argument, since claim 1 specifies that the ceramic carrier is connected to the body of the lamp without giving any details of the intended type of connection. A mechanical connection between the LED carrier and the body which merely holds the carrier in place, but does not provide any thermal path for removing the heat is also covered by the claim and disclosed eg in document D3.
- 6.12 For the reasons set out above, the lamp according to claim 1 does not involve an inventive step within the meaning of Article 56 EPC.

7. *3rd auxiliary request*

- 7.1 Towards the end of the oral proceedings before the board, the appellant proprietor submitted a 3rd auxiliary request which was identical to the 2nd auxiliary request except that claim 1 and the claims depending on it had been deleted from it.

- 7.2 It is the established jurisprudence of the Boards of Appeal that belated amendments to the claims should be admitted during appeal oral proceedings only if the amended claims are clearly allowable (cf eg T 270/90, OJ 1993, 725).
- 7.3 Independent claim 8 of this request is directed to a lamp for an external warning light comprising *inter alia* visible and infrared LEDs. A current limiting device is "connected in direct series" between the terminals of the lamp and the array of LEDs. As mentioned in point 5 above the use of this expression in the claims is not permissible either under Article 123(2) EPC or Article 84 EPC. Consequently, the board decided not to admit this request as the claims would not be allowable as they stand.

Order

For these reasons it is decided that:

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

Registrar

Chair

D. Meyfarth

R. G. O'Connell