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D E C I S I O N
of 16 November 2001

Case Number: T 1213/97 - 3.5.2

Application Number: 89122851.2

Publication Number: 0373567

IPC: H01J 61/30

Language of the proceedings: EN

Title of invention:
Low-pressure mercury vapor discharge lamp

Patentee:
Toshiba Lighting & Technology Corporation

Opponent:
Osram GmbH FI/Patentwesen

Headword:
-

Relevant legal provisions:
EPC Art. 56, 83, 123(2)
EPC R. 60(1)

Keyword:
"Patent lapsed in all designated states - request to continue opposition"
"Added subject-matter - main request (yes)"
"Insufficient disclosure to support first auxiliary request (yes)"
"Inventive step - second auxiliary request (yes)"

Decisions cited:
T 0435/91; T 0409/91; T 0329/88

Catchword:
-

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Case Number: T 1213/97 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 16 November 2001

Appellant: (Opponent)
Osram GmbH
FI/Patentwesen
Postfach 22 16 34
D-80506 München (DE)

Respondent: (Proprietor of the patent)
Toshiba Lighting & Technology Corporation
4-28, Mita 1-chome
Minato-ku
Tokyo-To (JP)

Representative:
Liesegang, Roland, Dr.-Ing.
Forrester & Boehmert
Pettenkoferstraße 20-22
D-80336 München (DE)

Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted on 10 October 1997 rejecting the opposition filed against European patent No. 0 373 567 pursuant to Article 102(2) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: J.-M. Cannard
B. J. Schachenmann

Summary of Facts and Submissions

I. The opponent appealed against the decision of the opposition division rejecting the opposition filed against European patent No. 0 373 567.

II. The following prior art documents:

D1: EP-A-0 327 346

D4: US-A-4 694 215

D7: GB-A-2 157 883

D9: EP-A-0 157 440

D10: DE-B-2 625 954

D14: Philips techn. Rundschau, vol. 38, 1979, Nr. 1, J. Bloem et al, pages 12 to 17

D16: IES Transaction, Journal of IES, April 1977, J. Bloem et al, pages 141 to 147,

and pieces of evidence:

B1: a lamp of type OSRAM DULUX 9W

B4: Product information concerning lamps of type DULUX 7W, 9W and 11W,

cited in support of the opposition remain relevant to the present appeal.

III. Independent claims 1 and 4 of the patent in suit as granted (main request) read as follows:

Claim 1:

"A low-pressure mercury vapor discharge lamp having a glass tube (10) comprising at least two parallel straight portions (111) and one or more folded portions (114) connecting said straight portions (111) at the ends thereof, the tube (10) having two end portions arranged in the same direction, a pair of electrodes provided in said end portions and amalgam (15) provided in the end portions of said tube for controlling the mercury vapor pressure,

characterized in that the inner diameter (D_1) of the straight portions (111) of said tube (10), the inner diameter (D_2) of said folded portion (114) at the corner (18) thereof and the inner diameter (D_3) of a summit portion (17) of said folded portion (114) satisfy the relationship $D_3<D_1<D_2$; and that the mercury vapor pressure at a solid and liquid phase coexisting critical temperature of said amalgam is in the range of 1.33 to 26.6 Pa (0.01 to 0.2 Torr)."

Claim 4:

"A low-pressure mercury vapor discharge lamp having a glass tube (1) comprising two parallel straight portions (11) each having a first end portion arranged in a first direction and a second end portion (12) in the opposite direction, an electrode being provided in each first end portion, the two straight tube portions (11) being joined near their second end portions by a transverse connecting tube (13) and amalgam (5) provided in the first end portions for controlling the mercury vapor pressure,

characterized in that a distance l between a center line (15) of said transverse connecting tube (13) and an inner surface of the second end portion (12) of the straight portion (11) satisfies the relationship $l \leq 0.8\ D_1$ with an inner diameter (D_1) of said straight tube portions, and

that the mercury vapor pressure at a solid and liquid phase coexisting critical temperature of said amalgam is in the range of 1.33 to 26.6 Pa (0.01 to 0.2 Torr)."

Claims 2 and 3 are dependent on claim 1.

IV. In a communication accompanying a summons to oral proceedings, the Board indicated that it was inclined to the view that:

- the generalisation in claim 1 of the four specific amalgams I to IV originally disclosed to all amalgams having a mercury vapour pressure at the critical temperature in the claimed range of pressure extended beyond the original content of the application,

- the disclosure of the invention was not sufficiently complete to allow it to be performed in the whole range of claimed mercury vapour pressure at the critical temperature,

- the subject-matters of claims 1 and 4, if restricted to the four amalgams I to IV specifically disclosed, would probably be found novel and involving an inventive step over the cited prior art.

V. In a letter of reply dated 22 April 2001 the respondent/proprietor argued that the patent as granted satisfied the requirements of the EPC and filed sets of amended claims according to a first and a second auxiliary request.

The set of claims according to the first auxiliary request differs from the set of claims according to the main request in that the last feature of claim 1 is replaced by the phrase:

"and that said amalgam is selected from the group consisting of amalgams according to one of the following compositions:

- Bi(54.2 wt.%).Pb(41.8 wt.%).Hg(4.0 wt.%)

- Bi(53.2 wt.%).Pb(40.9 wt.%).In(1.9 wt%).Hg(4.0 wt.%)

- Bi(51.6 wt.%).Pb(39.6 wt.%).In(4.8 wt%).Hg(4.0 wt.%)

- Bi(48.9 wt.%).Pb(37.5 wt.%).In(9.6 wt%).Hg(4.0 wt.%)."

The set of claims according to the second auxiliary request differs from the set of claims according to the first auxiliary request in that the last feature of claim 4 is replaced by the phrase:

"and that said amalgam is selected from the group consisting of amalgams according to one of the following compositions:

- Bi(54.2 wt.%).Pb(41.8 wt.%).Hg(4.0 wt.%)

- Bi(53.2 wt.%).Pb(40.9 wt.%).In(1.9 wt%).Hg(4.0 wt.%)

- Bi(51.6 wt.%).Pb(39.6 wt.%).In(4.8 wt%).Hg(4.0 wt.%)

- Bi(48.9 wt.%).Pb(37.5 wt.%).In(9.6 wt%).Hg(4.0 wt.%)."

VI. By a letter dated 15 May 2001 the respondent/proprietor informed the Board that he would not participate in the oral proceedings and that the patent in suit had lapsed due to non-payment of the renewal fee in respect of all the designated States. He requested that the opposition appeal procedure be discontinued.

VII. In reply to a second communication from the Board the appellant/opponent withdrew his request for oral proceedings and requested a decision based on the state of the file. In the notice of appeal, the appellant had requested that the decision under appeal be set aside and the patent be revoked.

VIII. The oral proceedings were cancelled.

IX. The arguments of the appellant/opponent can be summarized as follows:

(a) Article 100(c) EPC

A simple U-shaped lamp as defined in original independent claim 5 was not covered by original claim 1 since the low temperature region was not dependent on the same parameters in a U-shaped lamp (column 7, lines 6 to 17 of the published application) as in the lamp according to original claim 1 (column 8, lines 16 to 31; column 9, lines 12 to 22). It was not clear that the general disclosure about the lamp of the invention

(column 7, line 43 to column 8, line 55) related to a simple U-shaped lamp. Neither the original disclosure, read as a whole, nor the specific indication at column 6, lines 51 to 53, that the same amalgams I to IV were used in both the U-shaped and the H-shaped lamps specified unambiguously that the mercury vapour pressure at the critical temperature in the U-shaped lamps was in the range from 0.01 to 0.2 Torr. Accordingly, granted claim 1, in which features taken from original claim 5 had been combined with a phrase from original claim 1, namely: "the mercury vapour pressure at a solid and liquid phase coexisting critical temperature is in the range from 0.01 to 0.2 Torr" contravened Article 123(2) EPC.

(b) Article 100(b) EPC

The geometry of the discharge passage of the lamp was so vaguely disclosed that it was not possible to derive therefrom the operating temperatures of the lamp. No other amalgams than the four specific amalgams I to IV were derivable from the application documents. Essential parameters, such as the critical temperature value, or critical temperature range, of suitable amalgams, were not disclosed in the application. Since the critical temperature at a solid and liquid coexisting phase did not correspond for a given amalgam to a single temperature value, but to a temperature range, the mere definition of a pressure range for the critical point of the amalgam in the patent in suit was not sufficient to specify a suitable vapour versus temperature curve and a corresponding specific amalgam. The disclosure of the invention, and particularly the curves in figure 5, thus did not teach the range of operating temperatures in the various operating conditions of a lamp. Accordingly, the scope of the protection conferred by the patent in suit, which extended to a family of amalgams, did not correspond in

its generality to the technical contribution to the art, which was restricted to four specific examples (see T 409/91). Moreover, amalgams were historically used in a compact mercury vapour discharge lamp to prevent the mercury vapour pressure rising above an optimum value (6.10^{-3} Torr) at high operating temperatures. However the amalgams disclosed in the patent in suit, whose critical point is situated above 10^{-2} Torr, did not maximize the light flux or the efficiency of the lamp, nor did the patent teach another optimum value for said mercury vapour pressure, although optimization of the lamp efficiency was presented in the description as an aim of the invention. Furthermore, in the absence of any concrete indication about the geometrical dimensions and the related operating temperatures of the lamp, the disclosure was not sufficiently complete to avoid formation of mercury droplets.

(c) Article 100(a) EPC

The geometric features and the amalgam of the claimed lamps were disclosed in document D1 (see the figures), which related to an amalgam for a compact low mercury vapour pressure discharge lamp of the H-shaped or U-shaped type. Accordingly the subject-matter of claims 1 and 4 lacked novelty.

The decision of the opposition division that the lamps according to claims 1 and 4 involved an inventive step was incorrect in the following respects:

- D9 disclosed a low-pressure mercury vapour discharge lamp whose amalgam had a mercury percentage comprised between 1 and 6% (page 2) and a mercury vapour pressure at the critical point

above 10^{-2} Torr; the teaching of D9 was general and the skilled person would combine it with B1 or B4, which related to a discharge lamp disclosing the geometric dimensions of the claimed lamps;

- D4 (column 1, lines 44 to 65; column 5, penultimate paragraph) and D7 (page 1, lines 54 to 58) disclosed also lamps arranged to avoid formation of mercury droplets; more specifically D7 taught that such an effect was also obtained in U-shaped lamps with various dimensions by using an amalgam which controlled the mercury vapour pressure.

X. The arguments of the respondent/proprietor can be summarized as follows:

(a) Article 100(c) EPC

It was clear from the originally filed description (see column 3, lines 22 to 25; column 4, line 57 to column 5, line 7; column 7, line 33 to column 8, line 34) that the general characterization of the amalgams used in all the lamps according to the invention was that the mercury vapour pressure at a solid and liquid phase coexisting critical temperature was in the range of 0.01 to 0.2 Torr. The unlimited number of amalgams occurring within said range could only be represented by examples, namely the amalgams I to IV, which covered the complete claimed range in a representative way. Apart from its folded portion, the U-shaped lamp had the same configuration as the H-shaped lamp (column 6, lines 33 to 36) even if only amalgams I to IV were mentioned in respect of the U-shaped lamp (column 6, lines 51 to 53). An expert would

thus clearly understand, without exercising any inventive thought, that the invention was not restricted to the use of the amalgams I to IV, which were only examples given in respect of specific embodiments.

(b) Article 100(b) EPC

By utilizing amalgams with different content of mercury, an expert aware of D14 and D16 (figures 4 and 5) could without any difficulties shift the curves shown in figure 5 of the patent in suit in the lower temperature range or shift their critical point. Accordingly unlimited numbers of amalgams which would present a mercury vapour pressure at the critical temperature falling within the claimed range of pressures could be found and the disclosure was sufficiently complete. An expert might try to maximize the light flux and the efficiency of the lamp. However the lamps of the invention worked with different efficiencies depending on the ambient temperature and an optimization of their light flux was not part of the invention.

(c) Article 100(a) EPC

The respondent merely referred to the arguments concerning novelty and inventive step presented in the opposition proceedings.

Reasons for the Decision

1. The appeal is admissible.

The European patent in suit has expired for all the designated contracting states during the appeal proceedings. As was done in the case T 0329/88, the present Board has decided to apply the provisions of Rule 60(1) EPC to the present case. However, contrary to the situation in T 0329/88, in the present case, the appellant/opponent has requested a decision based on the state of the file, which implies a request for the opposition appeal proceedings to be continued for the purpose of issuing the decision. Consequently, the Board exercises its power under Rule 60(1) EPC to continue the appeal proceedings, particularly as the matter was ready for a decision to be taken.

2. *Proprietor's main request*

2.1 Granted claim 1 includes features taken from original claim 5 in combination with the feature "the mercury vapor pressure at a solid and liquid phase coexisting critical temperature of said amalgam is in the range of 1.33 to 26.6 Pa (0.01 to 0.2 Torr)", and relates to a U-shaped lamp according to the second embodiment of the invention.

2.2 The tube of the U-shaped lamp according to original claim 5 is configured in such away that at room temperature, mercury condenses in the low temperature region, whereas at high ambient temperature the mercury vapour pressure is controlled by the amalgam (see column 7 lines 6 to 17 of the published application). In the lamp according to original claim 1 the configuration of the tube is not restricted to a U-shaped form, but is such that a low temperature region is formed adjacent to a folded portion of the tube, or other than there, depending on the orientation of the lamp (column 9, lines 12 to 22, and column 8, lines 16 to 31 of the published application: base up, base down). The tube configuration according to original

claim 5 thus is not covered by the tube configuration according to original claim 1. Consequently, a lamp according to granted claim 1, which results from the restriction of the unspecified amalgam according to original claim 5 to an amalgam having properties recited in original claim 1, namely having at the critical temperature a mercury vapour pressure within the range of 0.01 to 0.2 Torr, is not directly and unambiguously derivable from the original claims.

2.3 A U-shaped lamp according to the second embodiment of the invention is disclosed in the original application (column 6, lines 31 to 53) with reference to figures 3 and 4 and comprises one of the four amalgams I, II, III and IV (column 6, lines 51 to 53). But there is in the original application no disclosure of the more general concept of a U-shaped lamp according to granted claim 1, namely comprising any other amalgam having at a critical temperature a mercury vapour pressure in the range of 1.33 to 26.6 Pa.

2.4 The respondent argued that the amalgams employed in the various embodiments of the originally disclosed lamp are the same, and thus comprise, in general, amalgams having at a critical temperature a mercury vapour pressure in the range of 1.33 to 26.6 Pa, which are used in the H-shaped lamp of the first embodiment (column 4, line 57 to column 5, line 27). However the indication at column 6, lines 33 to 36, that (apart from being H-shaped or U-shaped) the configurations of the H-shaped and U-shaped lamps are identical, cannot be interpreted as meaning that all the possible amalgams specified for the first embodiment may be used in the second embodiment, since the issue of the amalgams used in the second embodiment is explicitly considered in a separate paragraph (column 6, lines 51 to 53) specifying quite clearly that "the same amalgams I, II, III and IV as the first embodiment

described above are employed".

2.5 The respondent's argument that the considerations set out from column 7, line 57 to column 8, line 34 apply to all the described embodiments is not disputed. However the sentence at column 8, lines 31 to 34 of the published application appears to be a reference to the properties of the amalgams used in the embodiments as previously disclosed, namely in the case of the U-shaped lamp the amalgams I to IV (see column 6, lines 51 to 53), rather than a disclosure that any such amalgams could be used in a U-shaped lamp.

2.6 The same conclusions apply to the statement at column 7, lines 43 to 56: "The reason why the solid and liquid phase coexisting melting point of the main amalgam 5 as the mercury vapor pressure is in the range of 0.01 to 0.2 Torr is as follows".

2.7 The phrase "the low-pressure mercury vapor discharge lamp of the present invention employs amalgam in which mercury is weakly condensed" (column 3, lines 22 to 25 of the published application) quoted by the respondent merely specifies in a very general way one of the properties of the used amalgam and does not define any clear parameter of said amalgam.

2.8 Moreover, even if an expert, as alleged by the respondent, would be able to apply the teaching specifically related to the amalgam used in the first embodiment (H-shaped lamp) in an analogous manner to the second embodiment (U-shaped lamp), this does not mean that such an analogous application is disclosed in the originally filed application. Rather, the expert would be using his own imagination to go beyond the original disclosure.

2.9 In view of the foregoing, a U-shaped lamp which uses an amalgam having a mercury vapour pressure at a critical temperature in the range of 0.01 to 0.2 Torr, other than the amalgams I to IV, is not unambiguously disclosed in the original application. Consequently the Board judges that the generalisation in granted claim 1 of the four specific amalgams I to IV originally disclosed to all amalgams having a critical temperature in the range of 0.01 to 0.2 Torr defines a lamp which extends beyond the original content of the application (Article 123(2) EPC). The ground for opposition under Article 100(c) EPC thus prejudices the maintenance of the patent in suit unamended.

3. *Proprietor's first auxiliary request*

The subject-matter of claim 1 according to the first auxiliary request is restricted to a lamp comprising one of the four amalgams I to IV which according to the original application are used in the U-shaped lamp (see *supra* 2.3). The Board is thus satisfied that this claim does not contravene Article 123(2) EPC.

4. According to the appellant (see the statement of grounds of appeal, point 3.1.3), the properties of an amalgam and its suitability for use in the lamp of the invention cannot be described only by referring to the mercury vapour pressure at a critical temperature which corresponds to a particular point of the curve representing the mercury vapour pressure versus the temperature. This argument applies to claim 4 of the main request and first auxiliary request.

4.1 An explanation of the expression "critical temperature" is given in the original description (column 5, lines 16 to 19 and figure 5 of the published application) according to which said temperature for a given amalgam is defined by the abscissa of the

critical point C where the solid and liquid phase coexist. This definition has not been disputed by the appellant and seems to be consistent with the well-recognized meaning of said expression in the relevant art.

4.2 According to D16, figure 2, the critical point of the curve representing the mercury vapour pressure vs the temperature corresponds to the critical temperature T2, above which the coexistence of the solid and liquid phases in equilibrium with the gas phase no longer exists. It appears from figures 4 to 6 of D16 that the coordinates of the critical point depend on the constituents of the amalgam and for given constituents on the mercury content. Consequently, the critical point and critical temperature are specific parameters of a given amalgam having a given mercury content. However, as this appears more specifically from figure 6, two different amalgams with a different mercury content may show the same critical temperature and vapour pressure at the critical point. Accordingly, the Board shares the appellant's view that the choice of a suitable amalgam for use in the lamp of the invention cannot be determined only by reference to its mercury vapour pressure at the critical temperature.

5. Having regard to Article 100(b) EPC the appellant argues, *inter alia*, that simply defining the critical point C by the mercury vapour pressure value is neither necessary nor sufficient to carry out the invention (statement of grounds: point 3.2.1) and that the invention cannot be performed throughout the whole range claimed since only four specific amalgams of a "family" are disclosed and it is not clear how their compositions should be generalized (point 3.1.6).

5.1 Since claim 4 only defines a range of mercury vapour pressure for the critical point of the amalgam, all

amalgams in which the critical temperature of coexistence of solid and liquid phases occurs at a mercury vapour pressure value in the range of 0.01 to 0.2 Torr specified in the claim fall within the terms of the claim. However, no criteria are disclosed in the patent in suit for selecting among all the above amalgams those which have a vapour pressure versus temperature curve allowing the lamp to work.

5.2 The patent and more specifically claim 4, defines in a general way the amalgam by specifying the range for one of its parameters, namely the mercury vapour pressure at a solid and liquid phase coexisting critical temperature. This mode of definition covers an indefinite number of possible amalgams, which may have quite different compositions, and more specifically various constituents, as long as they show the desired mercury vapour pressure at the critical temperature. In such a situation, at least a representative number of examples of these possible amalgams must be disclosed in the patent in order to make the invention available to the skilled person throughout the scope of claim 4 without undue burden. However the skilled man cannot find in the patent in suit, taking into account, if necessary, the relevant common general knowledge, any teaching of how to select suitable examples of such amalgams (see T 435/91, OJ EPO 1995, 188, point 2.2 and T 409/91, OJ EPO 1994, 653, points 3.4 and 3.5).

5.3 According to the respondent it would be possible without any difficulties for an expert to find unlimited numbers of other amalgams, in addition to amalgams I to IV, which fit into the definition given in the patent in suit, for instance by shifting the curve in the lower temperature range or shifting the critical point by using amalgams with different mercury content. However since the ranges of temperatures and pressures in which the operation of the lamp should

take place are not disclosed, the skilled person cannot find in the patent any teaching or criteria for selecting among said unlimited numbers of amalgams those which could be used in the lamp. Moreover the amalgams which fall within the scope of the independent claims are not limited to the family consisting of the amalgams obtained by shifting the curve or the critical point of the amalgams I to IV (see *supra* 4.2 and 5.2). The respondent's argument does not prove that the patent discloses a method to find such amalgams falling within the scope of claim 4, and not belonging to the above family. On the contrary, it leaves the whole burden of this work to the person skilled in the art.

5.4 For the foregoing reasons, the scope of claim 4 extends to amalgams which in their generality far exceed the teaching in the patent, which is limited to the four specific amalgams I to IV. The disclosure is not sufficiently clear and complete to allow the invention to be performed in the whole range covered by claim 4, and thus the ground for opposition under Article 100(b) EPC prejudices maintenance of the patent with this claim.

6. *Proprietor's second auxiliary request*

6.1 The subject-matter of claims 1 and 4 according to the second auxiliary request is restricted to a lamp comprising one of the four amalgams I to IV defined in the original application. The Board is thus satisfied that these claims are maintainable in the face of the grounds for opposition under Article 100(c) and (b) EPC.

6.2 The appellant has not disputed that a lamp as defined in claims 1 and 4 according the second auxiliary request lacks novelty or an inventive step. The Board is also satisfied that these claims define novel

subject-matter involving an inventive step, since lamps comprising a tube with the dimensional relationships and having one of the amalgams recited in these claims are neither disclosed nor suggested by any of the prior art documents cited by the appellant.

7. In the Board's judgment, taking into account the amendments according to the second auxiliary request the patent in suit and the invention to which it relates satisfy the requirements of the Convention (Article 103(3) EPC).

8. The Board, aware of the fact that the patent has lapsed in all designated states, remits the case to the department of first instance for the purpose of determining retroactively the protection conferred (Article 69(2) EPC, second sentence). The description and drawings do not require amendments.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent as amended on the basis of claims 1 to 4 filed as second auxiliary request with letter dated 22 April 2001. (see point 8 of reasons)

The registrar:

Monica Hörnell

M. Hörnell

The chairman:

W.J.L. Wheeler