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Bezeichnung der Erfindung: Halogen incandescent lamp
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : H01K 1/28, H01K 1/38, C03C 3/30

ENTSCHEIDUNG / DECISION
vom / of / du 14 July 1988

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent / Titulaire du brevet : Kabushiki Kaisha Toshiba

Einsprechender / Opponent / Opposant : Osram GmbH

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Schlagwort / Keyword / Mot clé : "Inventive step (no)"

Leitsatz / Headnote / Sommaire

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Case Number : T 235/87 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 14 July 1988

Appellant : (Proprietor of the patent)
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Decision under appeal :
Decision of the Opposition Division of the European Patent Office dated 10 December 1986 revoking European patent No. 019 850 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : K. Lederer
Members : E. Turrini
R. Schulte

Summary of Facts and Submissions

I. The Appellant (Patentee) is owner of European patent 0 019 850 (application number 80 102 835.8).

II. The Respondent (Opponent) filed notice of opposition against the European patent and requested revocation of the patent in its entirety on the grounds of non-patentability because of lack of inventive step and failure to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. His arguments in support of the former ground for opposition relied inter alia on the following documents:

D1 : US-A-3 496 401

D2: DE-A-2 433 303

D3: Kirk-Othmer, Encyclopedia of Chemical Technology, Volume 10, J. Wiley & Sons, 2nd edition, 1966, page 542, Table 3.

D9: US-A-4 163 171

D11: "Die chemische Zusammensetzung der Vakuumtechnischen Gläser", O. Knapp, Silikattechnik, 6. Jg., 3. Heft, March 1955, pages 99-104.

The Appellant requested that the patent be maintained in an amended form on the basis of a set of claims of which the sole independent claim reads:

"1. A halogen incandescent lamp (1) performing halogen cycles in operation, comprising

(a) a bulb (2) formed of aluminosilicate glass having a strain point of 660°C or higher and an average thermal expansion coefficient of 41 x 10^{-7} to 48 x $10^{-7} \cdot C^{-1}$ at a temperature of 100 to 300°C, in which gas containing halogen atoms and an inert gas are enclosed,

(b) a tungsten filament (3) with a working temperature of 2,800K or more contained in said bulb (2),

(c) at least a pair of lead-in wires (4, 6) connected to or integrally formed on the ends of that tungsten filament (3), respectively, and having a part sealed in said bulb (2) wherein at least filament-side seal portions of said lead-in wires (4, 6) are molybdenum wires,

(d) wherein said aluminosilicate glass has the principal ingredients SiO_2, Al_2O_3, CaO, MgO and B_2O_3,

characterized in

(e) that said aluminosilicate glass has the composition as follows:

SiO_2:	55 to 65 wt.%
Al_2O_3:	15 to 22 wt.%
CaO:	5 to 10 wt.%
MgO	6 to 10 wt.%
B_2O_3:	3 to 6 wt.%,

accompanying oxide:	very small amount
residual flux:	very small amount
residual clarifying agent:	very small amount

(f) that said molybdenum wires have a diameter of 0.4 to 0.6 mm."

Claims 2 to 9 are appended to Claim 1.

III. The Opposition Division revoked the patent on the ground of lack of inventive step in the subject-matter of Claim 1. It considered in particular that the glass composition set out in the claim was obvious from the disclosure of document D2 as read in the light of document D3, which disclosed a composition falling within the claimed ranges with regard to the principal ingredients and from the disclosure of document D9, which taught to minimise the Na_2O content in aluminosilicate glasses for halogen incandescent lamps. In addition, the claimed range for the diameter of the molybdenum wires was considered to be no more than the result of an obvious parameter optimisation in an interval between values known respectively from documents D2 (0.33 mm) and S.T. Henderson and A.M. Mardsen, "Lamps and Lighting", Edward Arnold (Publishers) Ltd., 1972, London, pages 141, 142 (D12) (0.8 mm). The last document was cited by the Opposition Division of its own motion.

IV. The Appellant lodged an appeal against the decision.

V. Oral proceedings were held at the end of which the Appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the claims, description and drawings handed over during the proceedings.

Claim 1 of the effective set of claims is identical with Claim 1 on which the appealed decision was based.

The Respondent requested that the appeal be dismissed.

VI. The Appellant supported his request essentially by the following arguments:

The subject-matter of Claim 1 differs from the halogen incandescent lamp described in document D2 by the glass composition of the bulb and by the diameter of the molybdenum wires as set out in the claim, features (e) and (f).

With respect to the glass composition, document D2 discloses the use of a "Corning 1720" glass. Corning 1720 is the commercial name of a glass brand which has changed in composition through the years, as can be seen from a comparison between the compositions given in documents D11 (dated 1955) and D3 (dated 1966). In particular, there was no Na_2O included in the former glass composition whereas the latter comprises 1% by wt. of it. Since, however, document D2 has been drafted in 1973 (priority date of the patent application), the Corning 1720 glass referred to therein must be assumed to be the one actually available at that date under the latter designation, i.e. the glass referred to in document D3 and comprising 1 wt.% Na_2O. In contrast therewith, the claimed glass composition does not include any noticeable Na_2O content in excess of eventual "very small amounts" as provided for in Claim 1, which indication the skilled person would construe as covering unavoidable trace elements only. The claimed composition therefore embodies a radical departure from the earlier trend to add Na_2O to the glass mixtures as evidenced by the evolution of the Corning 1720 glass composition.

As concerns the claimed range for the diameter of the molybdenum wires, document D12 discloses that a Dumet wire for direct sealing in aluminosilicate glasses should desirably have a diameter of 0.8 mm or less. Dumet wires

exhibit a composite structure consisting of a central core of Fe-Ni alloy and an outer Cu sheet, and their thermal expansion coefficient in the axial direction differs from that in the radial direction. It has now been found that such composite wire structure may be dispensed with when using molybdenum wires having diameters up to 0.6 mm in combination with the claimed glass composition which insures optimal adaptation of the respective thermal expansion coefficients. In addition, leakage occurrence in lamp bulbs made of aluminosilicate glass with molybdenum wires directly sealed therein is minimal when there is no BaO contained in the glass and when the wire diameter is between 0.2 and 0.6 mm, as evidenced by experimental data submitted with Appellant's letter dated 21 June 1988. The claimed diameter values between 0.4 and 0.6 mm further result in lower wire temperatures in use as compared with the lower diameter value of 0.33 mm known from document D2 and thus also prevent cracking of the aluminosilicate glass, which occurs when the glass is heated at temperatures above about 450°C.

Moreover, features (e) and (f) of Claim 1 should be evaluated in combination with each other, since the claimed lack of any Na_2O in the glass composition allows optimal adaptation of the thermal expansion of the aluminosilicate glass to the thermal expansion of molybdenum wires of a diameter comprised in the interval set out in Claim 1.

Finally, the Appellant offered to perform further tests and to submit corresponding experimental data in case the Board considered such data to be essential to the present issue.

VII. These arguments were contested by the Respondent who made essentially the following submissions:

Halogen incandescent lamps exhibit an increased lifetime as a result of the so-called "halogen cycle", which promotes redeposition on the filament of evaporated filament metal deposited on the inner wall of the bulb. Na_2O was known already to cause breaking up of the halogen cycle when included in the glass material of the bulb and it was therefore generally avoided in the glass compositions developed in the past and substituted to the more expensive quartz, such as Corning 1720. Corning 1720 is a glass of low Na_2O content, as is shown by documents D3 and D11 and its composition is encompassed by the definition given in Claim 1, since, according to the description of the attacked patent, "very small amounts" of accompanying oxides and residuals can constitute as much as 5 wt.% of the glass composition (column 5, lines 41 to 47). The claimed composition may therefore also encompass the 1 wt.% Na_2O content of the known Corning 1720 glass. The Appellant's allegation in this respect that the claimed composition does not include any Na_2O at all is not supported by the original application documents. In any case, patentability of the claimed subject-matter should not derive from a controversial interpretation of the meaning of the wording "very small amount", since granting a patent in these circumstances would deprive the whole industry in the field of halogen incandescent lamps of the freedom to keep using the prior art glass composition.

As concerns the diameter of the molybdenum wires, the experimental data submitted by the Appellant lack sufficient information as to the test conditions and cannot therefore be reproduced, but they show at least that the sealing performance achieved when using a 0.33 mm wire as disclosed in document D2 is just as good or even better than in a portion of the claimed range of from 0.4 to 0.6 mm, which confirms that the technical effect involved in

the latter feature is not novel. It is further obvious to select a somewhat larger diameter when the wire has not to be bent as it has in the design disclosed in document D2, in order to permit lower temperatures in use.

Furthermore, the patent documents do not even hint at any relationship between lack of Na_2O in the glass composition and wire diameter range.

Reasons for the Decision

1. The appeal is admissible.

2. There is no formal objection under Article 123(2) or (3) EPC to the current version of claims and specification. Neither did the Respondent allege any deficiency in this respect.

3. Novelty.

3.1 Document D2 discloses a halogen incandescent lamp performing halogen cycles in operation, comprising

(a) a bulb (2) formed of aluminosilicate glass (page 5, last paragraph) in which gas containing halogen atoms and an inert gas are enclosed (page 5, first paragraph),

(b) a tungsten filament (8) (page 5, second paragraph) with a working temperature of more than 2,800°K, namely 3,200°K (page 11, lines 9 to 11) contained in said bulb (2),

(c) at least a pair of lead-in wires (10) connected to or integrally formed on the ends of that tungsten

filament (8), respectively, and having a part sealed in said bulb (2) wherein at least filament-side seal portions of said lead-in wires (10) are molybdenum wires (Figure 1; page 5, second paragraph).

Although the document neither specifies the strain point nor the average thermal expansion coefficient at a temperature of 100 to 300°C of the aluminosilicate glass, but mentions the expansion coefficient at room temperature (description, page 5, last but one line to page 6, line 5), this prior art lamp actually verifies the latter parameter values as admitted by the Appellant (letter of 2 January 1986, Section I.2).

In addition, the bulb of the lamp known from document D2 may be made of a "Corning 1720" aluminosilicate glass (page 5 of the description, last paragraph) without giving an exact value of the ingredients forming the glass. Indeed, as it appears from documents D11 (table 2) and D3 (table 3) the composition of a Corning 1720 glass may change, although slightly, but it always contains SiO_2, Al_2O_3, CaO, MgO and B_2O_3 as is called for by feature (d) of Claim 1. Moreover, the values of the ingredients of a Corning 1720 glass fall within (D3) or at least very near (D11) the respective ranges explicitly indicated for the ingredients mentioned in feature (d) of the aluminosilicate glass of Claim 1 and the amount of accompanying oxide is to be considered as "very small" because it contains only 1 wt.% or less of Na_2O and is free of BaO or other oxides as evidenced by documents D3 and D11. Finally, residual flux and residual clarifying agent normally being kept in such glasses as low as possible, these properties are to be considered as implicitly disclosed by document D2. The Appellant did not submit any argument allowing a different assessment of novelty of these two features.

Thus, the subject-matter of Claim 1 differs from the halogen incandescent lamp known from document D2 in that:

- the wire diameter is in the range of 0.4 to 0.6 mm, while in document D2 the value of 0.3302 mm is mentioned (page 6, line 25).

3.2 Document D1 discloses a halogen incandescent lamp performing halogen cycles in operation, comprising

(a) a bulb (10) formed of aluminosilicate glass having a strain point higher than 660°C (column 7, table, Example VII) and an average thermal expansion coefficient of 46 x $10^{-7} \cdot C^{-1}$ at 0° to 300°C (column 7, table, Example VII) which substantially falls within the corresponding range claimed in Claim 1, in which bulb gas containing halogen atoms and an inert gas are enclosed (column 3, line 11),

(b) a tungsten filament (18) (column 3, line 7) contained in said bulb (2),

(c) at least a pair of lead-in wires (14, 15) connected to the ends of that tungsten filament, respectively (column 3, line 7), and having a part sealed in said bulb (Figure 1),

(d) wherein said aluminosilicate glass has the principal ingredients SiO_2, Al_2O_3, CaO, MgO and B_2O_3 (column 7, table, Example VII), the values of the SiO_2 and MgO falling within the corresponding ranges set out in Claim 1, and has a very small amount of accompanying oxide (column 7, lines 22 and 23" ... a maximum of 0.10 percent by weight of alkali metal oxide").

Apart from the fact that document D1 does not specify the working temperature of the tungsten filament, the lamp disclosed in document D1 distinguishes over the subject-matter of Claim 1 in that the filament-side seal portions of the lead-in wires are made of tungsten (column 3, lines 4 to 8) of not specified diameter instead of molybdenum wires of a diameter of 0.4 to 0.6 mm, and by the following differences in the glass composition:

Al_2O_3: 14,8 wt.% instead of 15 to 22 wt.%
CaO: 11,9 wt.% instead of 5 to 10 wt.%
B_2O_3: 7,95 wt.% instead of 3 to 6 wt.%.

3.3 The remaining cited documents do not come closer to the subject-matter of Claim 1.

3.4 For these reasons, the subject-matter of Claim 1 is considered to be novel in the sense of Article 54 EPC.

4. Inventive step.

4.1 The nearest prior art is constituted by the halogen incandescent lamp described in document D2.

As already set out in section 3.1, all that is new in the subject-matter of Claim 1 over the disclosure of document D2 is that the diameter of the lead-in-wires is between 0,4 and 0,6 mm instead of 0,33 mm.

Thus, in the absence on the file of any convincing evidence to the contrary, the sole technical problem to which the features of Claim 1 distinguishing from the disclosure of document D2 appear to afford a solution, if any, is to improve the design of the prior art lamp in such a way as to reduce the temperature of the molybdenum wires in use, for avoiding cracking of the glass bulb material in contact

therewith. In this respect, the experimental data submitted in his letter dated 21 June 1988 show that the additional effect put forward by the Appellant of an optimal adaptation of the thermal expansion of molybdenum wires exhibiting a diameter in the range defined in Claim 1 with that of bulbs made of glass not containing BaO also arises in the prior art lamp of document D2, which does not contain BaO either, since the leakage occurrence rate in such bulbs as indicated by the curve in Figure A for a diameter of about 0,33 mm is as low as or even lower than the maximum leakage occurrence rate in the interval between 0.4 and 0.6 mm.

4.2 There can be seen no positive contribution to an inventive step in recognition of the technical problem per se, since, in particular, document D2 clearly teaches that the temperature in use of any portion of the aluminosilicate glass bulb should not exceed 500°C (description page 10, third paragraph, first sentence), which gives a hint to a skilled person that excessive heating of the bulb by the lead-in wires should be avoided too.

4.3 Starting from the halogen incandescent lamp known from document D2 and faced with the above defined technical problem, any person having elemental knowledge of the laws of electricity would immediately recognise that the heat dissipated by the molybdenum wires as a result of the current flowing therethrough is proportional to the wire resistance, which is itself inversely proportional to its cross-section, and that, accordingly, decreasing the heat dissipation may readily be achieved by increasing the wire diameter. Assessing to which extent the wire diameter may be increased without jeopardizing the tightness of the seal between the molybdenum wires and the adjacent bulb portion under differential thermal expansion requires only the

performance of simple routine tests, which does not go beyond the normal skill of the designer of such lamps either.

4.4 The Board would not have reached a different conclusion, had it accepted the Appellant's submission that the glass composition specified in Claim 1 does not comprise any Na_2O at all, whereas Corning 1720 glass, at the time the invention underlying document D2 was made, did contain detrimental amounts of Na_2O.

In particular, this alleged additional distinguishing feature as compared with the lamp in accordance with document D2 is rendered obvious by the clear teaching in document D1 that, in order to prevent the formation of a white coating on the inner wall of a bulb of aluminosilicate glass in a halogen incandescent lamp, such glass either must be essentially completely free of alkali metal oxides (column 2, lines 39 to 42), or should not comprise alkali metal oxides in an amount exceeding 0,1% by weight (column 7, lines 22 and 23). This teaching would indeed lead the skilled person to further improve the lifetime of the prior art lamp in accordance with document D2 by modifying, if necessary, its glass composition in such a way as to reduce the Na_2O content therein to "very small amounts" in the sense of unavoidable trace amounts only.

4.5 The Board is not convinced either of the existence of an additional effect resulting from such alleged lack of Na_2O in the glass composition when combined with the range defined in Claim 1 for the diameter of the molybdenum wires and consisting in an improved adaptation of the thermal expansions of the glass bulb and the wires as further submitted by the Applicant.

4.6 With respect to the Appellant's offer to produce further test results or experimental data, the Board feels no need to make use of its power under Article 114(1) EPC to invite him to do so of its own motion. Neither did the Appellant himself specify which type of data he could further produce, nor which purpose such late submissions would still serve.

4.7 For these reasons, the subject-matter of Claim 1 is considered to lack an inventive step within the meaning of Article 56 EPC and Claim 1 is therefore not patentable (Article 52(1) EPC).

Accordingly, the ground for opposition set out in Article 100(a) EPC prejudices the maintenance of the patent in amended form as requested by the Appellant.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

F. Klein K. Lederer

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