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Bezeichnung der Erfindung: Long life, warm colour metal halide arc  
discharge lamp  
Title of invention:  
Titre de l'invention :

Klassifikation / Classification / Classement : H01J 61/44

### ENTSCHEIDUNG / DECISION

vom / of / du 2 February 1988

Anmelder / Applicant / Demandeur : GTE Products Corporation

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Einsprechender / Opponent / Opposant :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Kennwort / Keyword / Mot clé : "Inventive step (No)"

Leitsatz / Headnote / Sommaire

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Beschwerdekammern

Boards of Appeal

Chambres de recours

Case Number : T 319/86 - 3.4.1



**D E C I S I O N**  
of the Technical Board of Appeal 3.4.1  
of 2 February 1988

**Appellant :** GTE Products Corporation  
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**Representative :** Grünecker, Kindeldey, Stockmair &  
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**Decision under appeal :** Decision of Examining Division 047  
of the European Patent Office  
dated 17 April 1986 refusing European  
patent application No. 83 101 743.9  
pursuant to Article 97(1) EPC

**Composition of the Board :**

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

## Summary of Facts and Submissions

- I. European patent application No. 83 101 743.9 (publication number 0 087 745) was refused by decision of the Examining Division. That decision was based on Claims 1 to 3 as filed on 4 March 1985.
- II. The reasons given for the refusal were that the subject-matter of Claim 1 did not involve an inventive step having regard to documents NL-A-7 920 189 (A1) and US-A-3 825 792 (A2).
- III. The Appellant filed a notice of appeal.
- IV. Following a communication on behalf of the Board of Appeal, in which attention was drawn to US-A- 4 241 276 (A3), oral proceedings took place, whereby the Appellant requested that the decision of the Examining Division be set aside and a European patent granted with the documents mentioned in the communication dated 11 November 1987, i.e. on the basis of Claims 1 to 3 filed on 29 November 1985.

At the oral proceedings the Appellant filed the following new documents: Journal of IES, July 1984, pages 359 to 367 "Increased red output, low colour temperature metal halide lamps", E.F. Wyner et al. (A4) and a colour table.

- V. Present Claim 1 reads as follows:

"A high pressure metal halide arc discharge lamp comprising: an arc tube containing therein an inert gas, mercury and at least the halide of sodium and scandium, said arc tube, when operating, providing a light output having a spectral response which includes radiation in the

ultraviolet and blue regions of the optical spectrum but being substantially deficient in the red region of said spectrum, said light output of said arc tube having a colour temperature of over 4400°K; said arc tube being disposed within an outer jacket having a phosphor coating on the inner wall thereof; characterized in that said phosphor coating comprising a mixture of a first phosphor which absorbs radiation in the blue region of said spectrum and emits radiation in the red region, and a second phosphor which absorbs radiation in the ultraviolet region of said spectrum and emits radiation in the red region and that said first phosphor comprises about 40 weight percent to about 60 weight percent of said phosphor coating and the balance comprises said second phosphor; whereby the light emitted by said lamp has a colour temperature of about 3200°K to 3300°K."

Claims 2 and 3 are dependent on Claim 1.

VI. The Appellant argued essentially as follows:

Starting from the prior art corresponding to the preamble of Claim 1, a man skilled in the art wishing to lower the colour temperature would indeed consider document A2, which refers to high pressure mercury discharge lamps. However, according to document A2 the desired low colour temperature is obtained by coating on the inner wall of the outer jacket a non-luminescent oxide over which a coating of a phosphor mixture comprising first and second phosphors as those mentioned in Claim 1 of the application in suit, is added. The presence of the non-luminescent oxide coating is essential to obtain a colour temperature similar to that disclosed in Claim 1, so that the skilled man would be discouraged to use the mixture of the two phosphors alone.

The inventors discovered that, when the arc tube comprises metal halides, a proper combination of two phosphors alone lowers surprisingly the colour temperature as outlined in document A4, published after the filing date of the application in suit.

It is admitted that document A3 describes an arc discharge lamp which contains mercury and which may also contain metal halides, whereby a two phosphor coating allows a decrease of the colour temperature. However, there is no mention that the first phosphor absorbs radiation in the blue region, and the obtained results are not so good as those of the invention.

Moreover, document A1 discloses a metal vapour lamp having a phosphor coating similar to that of the invention. However, the arc tube of document A1 does not include metal halides, so that the light spectrum differs from that of the arc tube of the invention in suit. The skilled man would therefore not apply the phosphor coating described in document A1 to the inner wall of the outer jacket according to the prior art corresponding to the preamble of Claim 1, because he would expect totally different results.

Thus, although the elements of the invention are substantially known, the skilled man would not obtain the invention from the disclosures of the cited documents.

#### Reasons for the Decision

1. The appeal is admissible.

2. There is no objection to the present application on formal grounds, since it is adequately supported by the specifications as originally filed (Article 123(2) EPC).

More specifically, present Claim 1 includes the features of original Claims 1, 2 and 5, and present Claims 2 and 3 correspond to original Claims 3 and 4 respectively.

3. Novelty.

- 3.1. The features of the preamble of Claim 1 are considered, in combination, part of the prior art within the meaning of Article 54(2) EPC, as explicitly admitted also by the Appellant at the oral proceedings.

- 3.2. Document A1 refers to a high-pressure metal vapour arc discharge lamp (page 1, lines 4 and 5) comprising an arc tube (4) containing therein an inert gas and mercury (page 5, line 26), the arc tube being disposed in an outer jacket (3) having a phosphor coating (page 5, lines 19 and 20). The phosphor coating comprises a mixture of a first phosphor which absorbs radiation in the blue region of the spectrum and emits radiation in the red region (the manganese activated magnesium fluorogermanate mentioned on page 6, lines 22 and 23 has such properties as stated in the application in suit, present Claim 3), and a second phosphor which absorbs radiation in the ultraviolet region of said spectrum and emits radiation in the red region (the europium activated yttrium vanadate mentioned on page 6, line 8 has such properties as outlined in the application in suit, present Claim 3). The first phosphor comprises no more than 50% in weight of the phosphor coating and the balance comprises the second phosphor (page 6, second paragraph), whereby the light emitted by said lamp has a colour temperature of about 3200 to 3300°K (page 6, lines 9

and 10: an emission peak in a wavelength range of 610 to 630 nm corresponds to the colour temperature before mentioned as also outlined in the application in suit, page 4, paragraph 3).

Contrary to the subject-matter of Claim 1, document A1 refers to a discharge lamp whose arc tube contains zinc and cadmium instead of metal halides and the weight values in percentage of the first and second phosphors cover only a portion of the corresponding values mentioned in Claim 1.

- 3.3. Document A2 relates to a high pressure arc discharge lamp (column 1, lines 5 and 6) comprising an arc tube (16) containing an inert gas and mercury (column 3, lines 49 to 55). The arc tube is disposed within an outer jacket (12) having a phosphor coating (42) on the inner wall thereof (column 3, lines 56 to 61).

Said phosphor coating comprises a first phosphor which, being manganese activated magnesium fluorogermanate (column 6, lines 41 to 44), absorbs radiation in the blue region and emits radiation in the red region of the spectrum, and a second phosphor which, being europium activated yttrium vanadate (column 6, lines 37 to 40), absorbs radiation in the ultraviolet region and emits radiation in the red region of the spectrum.

Contrary to the subject-matter of Claim 1, the arc tube disclosed in document A2 does not contain metal halides, the weight values in percentage of the first and second phosphors (A2, column 6, lines 41 "10-30 percent" and 37 "70-90 percent" respectively) do not overlap the corresponding values mentioned in Claim 1, and the colour temperature (A2, column 2, line 64 "3000°K") is lower than that disclosed by Claim 1.

- 3.4. Document A3 describes a high pressure arc discharge lamp (column 1, lines 6 and 7) comprising an arc tube (1) containing therein mercury (column 1, line 7) (the inert gas is not explicitly mentioned) and a metal halide (column 1, line 37), the arc tube being disposed within an outer jacket (2) having a phosphor coating (5) which comprises a mixture of a first phosphor and of a second phosphor (column 2, lines 16 to 19). The second phosphor being europium activated yttrium vanadate (column 2, line 19), absorbs radiation in the ultraviolet region and emits radiation in the red region of the spectrum.

Contrary to the subject-matter of Claim 1, the metal halide contained in the arc tube is not defined as being halide of sodium or scandium, the first phosphor is not defined as having the property of absorbing radiation in the blue region and emitting radiation in the red region, there is only one weight value in percentage (40% for the first phosphor and 60% for the second phosphor) (column 2, lines 18 and 19) corresponding to the values disclosed in Claim 1 and the colour temperature is 3353°K (column 2, line 22), i.e. slightly outside the range disclosed in Claim 1.

- 3.5. The other cited prior art documents are more remote from the subject-matter of Claim 1 and, therefore, do not warrant detailed consideration here.
- 3.6. For the above reasons, the subject-matter of Claim 1 is deemed to be novel within the meaning of Article 54 EPC.



4. Inventive step.
- 4.1. The high pressure metal halide arc discharge lamp according to the preamble of Claim 1 is considered, as before outlined, part of the prior art. Starting from the disclosure of this prior art, the objective problem to be solved is to lower the colour temperature, i.e. to shift the emission spectrum from the ultraviolet and blue regions in direction of the red region, improving the efficiency and the life duration of the lamp, and providing a warm colour similar to that of incandescent lamps.
- 4.2. The problem is solved by the features of the characterising portion of Claim 1.
- 4.3. The identification of the problem is per se not inventive, since efforts to obtain warm colour lamps with improved efficiency and long life duration are known (document A1, page 1, lines 8 to 20; document A2, column 2, lines 45 to 49; document A3, column 1, lines 26 and 27).
- 4.4. As far as the solution of the problem is concerned, the man skilled in the art would as matter of course look at prior art high pressure arc discharge lamps and he would indeed be expected to consider documents A1 and A3.

Document A1 suggests to solve the problem by utilising a phosphor coating comprising two phosphors corresponding to those proposed in Claim 1. It also teaches to utilise weight values in percentage of the first and second phosphors which cover respectively half of the weight values in percentage mentioned in Claim 1 (the values 40 to 50% for the first phosphor and the corresponding 60 to 50% for the second phosphor).

It is true that the skilled man could think, prima facie, that the features of document A1 before mentioned would not solve the problem in case of a metal halide discharge lamp. He would, however, find a hint to go in the direction taught by document A1, in document A3, whereby also with halide lamps a mixture of two phosphors is utilised for the same purpose. It has to be remarked that said mixture has a percent composition corresponding to one of the percent compositions proposed by document A1 (40% for the first phosphor and 60% for the second phosphor), and that the second phosphor corresponds to the second phosphor of document A1. The skilled man is therefore not hindered to apply the features of the phosphor coating of document A1 to the discharge lamp of the prior art corresponding to the preamble of Claim 1. Moreover, there is no reason for the skilled man to limit his trials to the percent weight values of the two phosphors proposed in document A1. On the contrary, it would be routine for the skilled man to extend his trials to the whole range of values as proposed in Claim 1, because neither document A1 nor document A3 indicate that such extended trials would have drawbacks. He would thus obtain the subject-matter of Claim 1.

The Appellant's line of argumentation that document A2 would discourage the skilled man to choose a mixture of two phosphors as proposed in Claim 1, because the non-luminescent oxide coating mentioned in document A2 is an essential feature to obtain a low colour temperature (3000° K) and that the surprisingly good results attained by the choice of the mixture of two phosphors as outlined in Claim 1 would support the inventive step of the claim, is not agreed to by the Board of Appeal.

As far as document A2 is concerned, it is true that the non-luminescent oxide coating is an essential feature.

However, document A2 not only refers to discharge lamps without metal halides, but also the percent by weight of the two phosphors (10-30% for the first phosphor) and 70-90% for the second phosphor) are quite different from those proposed by documents A1 and A3, so that the teaching of document A2 would not deter the skilled man to make the above mentioned trials.

On the other hand, the good results obtained with a lamp according to Claim 1 (colour temperature of about 3200 to 3300°K) can be expected both by the teaching of document A3 whereby a colour temperature of 3353°K is obtained and by the teaching of document A1. Indeed, the latter document states that, starting from high pressure mercury discharge lamps including zinc or cadmium (but without phosphor) with a colour temperature higher than 6000°K, the addition of the two phosphor coating lowers the colour temperature to less than 5000°K (A1, table D).

Starting from a high pressure metal halide discharge lamp having a colour temperature of over 4400°K, the skilled man would therefore expect, as matter of course, to obtain colour temperatures lower than, e.g. 4000°K.

- 4.5. Thus, the subject-matter of Claim 1 is not considered to involve an inventive step within the meaning of Article 56 EPC and Claim 1 is, therefore, not allowable under Article 52(1) EPC.
- 4.6. Claims 2 and 3 are subordinate to Claim 1 and for this reason are also not acceptable.

Order

For these reasons, it is decided that:

The appeal is rejected.

The Registrar:

The Chairman:

F.Klein

K.Lederer