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# Datasheet for the decision of 4 December 2020

**Case Number:** T 2530/16 - 3.4.03

**Application Number:** 09792200.9

**Publication Number:** 2368259

**IPC:** H01J61/44, C09K11/78, C09K11/64, C09K11/81

**Language of the proceedings:** EN

**Title of invention:**
ENHANCED COLOR CONTRAST LIGHT SOURCE AT ELEVATED COLOR TEMPERATURES

**Applicant:**
General Electric Company

**Headword:**

**Relevant legal provisions:**
EPC Art. 52(1), 56, 123(2)

**Keyword:**
Inventive step - (main request, no, effect not made credible within the whole scope of claim)
Amendments - added subject-matter (auxiliary request, yes)

**Decisions cited:**
T 0939/92, T 2001/12

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 2530/16 - 3.4.03**

# D E C I S I O N
# of Technical Board of Appeal 3.4.03
# of 4 December 2020

| | |
|---|---|
| **Appellant:** (Applicant) | General Electric Company<br>1 River Road<br>Schenectady, NY 12345 (US) |
| **Representative:** | Dennemeyer & Associates S.A.<br>Landaubogen 1-3<br>81373 München (DE) |
| **Decision under appeal:** | **Decision of the Examining Division of the European Patent Office posted on 28 June 2016 refusing European patent application No. 09792200.9 pursuant to Article 97(2) EPC.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | G. Eliasson |
| **Members:** | S. Ward |
| | G. Decker |

## Summary of Facts and Submissions

I. The appeal is against the decision of the Examining Division refusing European patent application No. 09 792 200 on the grounds that the claimed subject-matter did not meet the requirements of Articles 83 and 84 EPC and did not involve an inventive step within the meaning of Article 56 EPC.

II. The appellant requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the main request or the auxiliary request, both filed with the statement of grounds of appeal.

III. The following document is referred to:

D1: US 2005/258733

IV. Claim 1 of the main request reads as follows:

*"A lamp (1) which when energized exhibits a correlated color temperature of between 3000 kelvin to 4500 kelvin and having an improved color quality scale (CQS), the lamp comprising at least one light-emitting element (7) having a light emission when energized, characterised in that when said lamp is energized said lamp generates light with a total light emission having delta chroma values as follows:*
*at least two color samples of the CQS are within the parameters*
*-5 to 2 for VS1;*
*-2 to 5 for VS2;*
*-5 to 0 for VS3;*

*at least one color sample of the CQS is within the parameters*
*-2.5 to 8 for VS4;*
*-2 to 15 for VS5;*
*at least two color samples of the CQS are within the parameters*
*0 to 21 for VS6;*
*3 to 22 for VS7;*
*2 to 7 for VS8;*
*at least two color samples of the CQS are within the parameters*
*-6 to 5.5 for VS9;*
*-4 to 5 for VS10;*
*-4 to 2 for VS11;*
*at least one color sample of the CQS is within the parameters*
*-0.5 to 5 for VS12;*
*1 to 12 for VS13; and*
*at least one color sample of the CQS is within the parameters*
*-7 to 4 for VS14;*
*-7 to 7 for VS15;*
*wherein said delta chroma values are measured in the CIE LAB space;*
*with the proviso that the lamp (1) does not comprise an incandescent light-emitting element, wherein the lamp is a low pressure mercury vapor discharge lamp and wherein said at least one light-emitting element is phosphor."*

Claim 1 of the auxiliary request comprises the features of claim 1 of the main request, and additionally the following features:

*"wherein the lamp (1) further comprises:*

*a combination of two or more light-emitting elements (7), said combination comprising a red light-emitting element having a peak emission in the range of from 590 to 670 nm, a first green light-emitting element having a peak emission in the range of from 500 to 570 nm, and a blue light-emitting element having a peak emission in the range of from 430 to 490 nm,*
*wherein a single light emitting element may emit one or more colors; and optionally further comprising at least one of an amber light emitting element and a blue-green light emitting element, and*
*wherein said red light-emitting element comprises Y203:Eu, said first green light-emitting element comprises (Ba,Sr,Ca)$MgAl_{10}O_{17}:Eu^{2+}$, $Mn^{2+}$, and said blue light-emitting element comprises (Ba,Sr,Ca)$MgAl_{10}O_{17}:Eu^{2+}$."*

V. The Board sent the appellant a communication under Article 15(1) RPBA setting out its provisional views that the subject-matter of claim 1 of the main request did not appear to meet the requirements of Articles 83 and 84 EPC or to involve an inventive step within the meaning of Article 56 EPC, and that the subject-matter of claim 1 of the auxiliary request did not appear to meet the requirements of Article 123(2) EPC.

VI. The appellant's arguments in the statement of grounds of appeal, insofar as they are relevant to the present decision, may be summarised as follows:

The present application was concerned with fluorescent lighting, which, conventionally, did not provide good colour rendering of illuminated objects. Accordingly, the objective problem was to provide a light source having a spectrum with improved colour rendering. This problem was solved by the claimed low CCT lamp.

Document D1, which represented the closest prior art, was not explicitly concerned with the problem of providing improved colour rendering, and taught away from a low CCT lamp by advocating a high CCT lamp as its sole example. There was no reason why the skilled person would depart from this aspect of the teaching of document D1, when seeking to address the objective problem. No other prior art document provided any motivation to modify the teaching of document D1 in this respect, let alone disclosed the parameters of the delta chroma values for low CTT lamps as defined in claim 1, which provided the technical effect of improved colour rendering as disclosed in the present application. The solution defined in claim 1 of the main request would therefore not have been obvious to the skilled person in view of the disclosure of document D1.

The application also met the requirement of sufficiency of disclosure (Article 83 EPC), and the claims of the main request met the requirements of Article 84 EPC.

Claim 1 of the auxiliary request was based on claim 1 of the main request, and further included the features of claim 3, and selected features of claims 6, 7 and 8 as originally filed, and accordingly satisfied the requirements of Article 123(2) EPC.

The subject-matter of claim 1 of the auxiliary request also met the requirements Articles 83 and 84 EPC, and involved an inventive step.

VII. The appellant was summoned to oral proceedings, which were to take place on 22 January 2021. In a

communication filed electronically on 14 October 2020 the appellant stated the following:

*"We herewith respectfully request the Boards of Appeal to take a decision based on the current state of the file. Further, we will not attend the Oral Proceedings scheduled on January 22, 2021."*

*"We herewith also withdraw our request for oral proceedings."*

The Board therefore notified the appellant that the oral proceedings were cancelled.

## Reasons for the Decision

1. The appeal is admissible.

2. *The Claimed Invention and the Examples in the Description*

2.1 Claim 1 of the main request essentially defines a low pressure mercury vapor discharge lamp having a phosphor light-emitting element and a correlated colour temperature (CTT) of between 3000 and 4500 K. The remainder of the claim essentially defines a set of ranges for delta chroma values for the 15 colour samples of the "Color Quality Scale" (CQS), and specifies particular requirements for six groupings within the 15 samples.

2.2 The following particular phosphors mentioned in the application will be referred to in the present decision:

- Yttrium Oxide:Eu ($Y_2O_3$:Eu), a red light emitting phosphor known as "YEO";
- (Ba,Sr,Ca)$MgAl_{10}O_{17}$:$Eu^{2+}$, a blue light emitting phosphor known as "BAM";
- (Ba,Sr,Ca)$MgAl_{10}O_{17}$:$Eu^{2+}$,$Mn^{2+}$, a first green light emitting phosphor known as "BAMn";
- $LaPO_4$:Ce,Tb, a second green light emitting phosphor known as "LAP".

Alternative known phosphors are listed in paragraphs [0052] and [0053].

2.3 The following examples and comparative examples of lamp arrangements are disclosed in the description:

Example 1 (paragraphs [0061], [0062]) has a phosphor layer comprising YEO, BAM and BAMn and a CCT of "about 17636 K".

Example 2 (paragraphs [0064], [0065]) has a phosphor layer comprising YEO, BAM, BAMn and LAP, and a CCT of "about 17952 K".

Example 3 (Table XII) comprises the same phosphors as example 1 (YEO, BAM, BAMn) and has a CCT of 5000 K.

Example 4 (Table XII) comprises the same phosphors as example 2 (YEO, BAM, BAMn, LAP), and has a CCT of 5000 K.

Example 5 (Table XIII) comprises the same phosphors as example 1 (YEO, BAM, BAMn) and has a CCT of 3500 K.

Example 6 (Table XIII) comprises the same phosphors as example 2 (YEO, BAM, BAMn, LAP), and has a CCT of 3500 K.

Comparative examples 1, 2 and 3 comprise a "conventional 'triphosphor'" layer comprising YEO, BAM and LAP, and have CCTs of "about 17993 K", 5000 K and 3500 K, respectively.

For all examples and comparative examples the weight percentages based on the total weight of the phosphors is given.

2.4 In the light of the disclosed CCT values, only examples 5 and 6 correspond to embodiments of the invention defined by claim 1, and only comparative example 3 provides a contrasting example using a "conventional triphosphor" layer within the claimed CCT range.

2.5 Claim 1 defines a lamp "having an improved color quality scale (CQS)"; the Board's understanding of this feature is as follows:

In paragraph [0023] the Color Rendering Index (CRI) is introduced as a conventional means of evaluating the colour rendering of a lamp by means of a metric termed Ra. Following a discussion of the disadvantages of this system, the Color Quality Scale (CQS) is introduced (paragraph [0024]), according to which colour rendering is characterised by fifteen individual CQS values, which are labelled VS1 to VS15, and "an overall Qa value", which "generally corresponds to the average of the individual CQS values".

2.6 It is apparent from the application as a whole, that the feature, "having an improved color quality scale (CQS)", refers to the *individual* CQS values, the improvement reflected in these values lying within the

claimed parameter space, and not to the lamp having an average value (Qa) greater than that of the prior art.

Examples 1 and 2 (which were embodiments of the invention defined by original claim 25, now deleted) have Qa values of 76 and 89. Comparative example 1 has a Qa value of 76, hence equal to that of example 1 (see paragraphs [0062], [0064] and [0067]). The following is stated in paragraph [0068]:

*"One key distinguishing feature between the lamps of Examples 1 and 2 on the one hand, and that of Comparative Example 1 on the other, is that a targeted group of individuals reported excellent color rendering of by the lamps of Examples 1 and 2, compared to illumination by the conventional triphosphor lamp of Comparative Example 1. Despite the fact that all three lamps had relative high aggregate Ra and Qa values in the CRI and CQS systems, the distinction was nevertheless apparent. This is due to the inventive VS values for certain CQS color chips, which chips are chosen for their relatively high chromatic saturation."*

2.7 The same pattern can be seen in the other examples. Examples 3 and 4 (which were embodiments of the invention defined by original claim 13, now deleted) have Qa values of 70 and 89, whereas comparative example 2 has a Qa value of 79 (Table XII), hence higher than that of example 3. Examples 5 and 6 (which are embodiments of the invention defined by present claim 1) have Qa values of 68 and 86, whereas comparative example 3 has a Qa value of 82 (Table XIII), hence higher than that of example 5.

2.8 Hence, the claimed "improved color quality scale" refers to the individual "inventive VS values" as

recited in the claim, and effectively merely labels them as "improved". This feature is not, therefore, seen as representing a further limitation over and above the claimed ranges and conditions for the VS values.

3. *Main Request: Inventive Step*

3.1 Although the Examining Division based its analysis of inventive step on D1, the Board indicated in its communication under Article 15(1) RPBA that an alternative starting point would be a commercially available low pressure mercury vapor discharge lamp having a correlated color temperature between 3000 and 4500 K, and having what the application describes as a "conventional 'triphosphor'" layer of YEO, BAM and LAP (see paragraphs [0067]-[0072]). The appellant has not challenged this statement (or made any substantive reply to the Board's communication). The Board therefore bases its analysis on such a conventional arrangement.

3.2 Claim 1 would differ from such a lamp in the requirements for the six groupings of delta chroma values for VS1 to VS15. For a conventional lamp it might of course happen that some of the delta chroma values would fall within the claimed ranges (such a lamp would be likely to have delta chroma values for VS1 to VS15 broadly similar to those of comparative example 3, which uses the same phosphors and has a CCT of 3500 K), but the Board accepts that it is implausible that all of the claimed requirements would be met.

According to the description (paragraph [0006]) the problem solved by imposing the claimed requirements is improved colour rendering.

3.3 To serve as the objective problem it must be plausible that essentially everything falling within the ambit of the claim would represent a solution to this problem. If this is not the case, the problem "may have to be reformulated, in particular in less ambitious terms, if it appears in view of experimental evidence that the combination of features in the claim does not solve this problem over the whole area defined in the claim" (see *Case law of the Boards of Appeal of the European Patent Office*, 9th edition 2019, I.D.4.4.1, first paragraph; see also I.D.4.3 and T 2001/12, Reasons, point 4.3).

3.4 In the present case, the question therefore arises whether it is plausible that the fifteen claimed ranges, and the respective conditions for the six claimed groupings, based on these ranges, define a region of parameter space within which the problem of improving the colour rendering is solved. The question could also be posed as follows: how has the applicant-appellant determined that the problem is solved throughout the defined region?

3.5 Paragraph [0028] provides a method for determining the 15 delta chroma values corresponding to VS1 to VS15. This information, together with a determination of the CCT, would enable a skilled person to verify whether a given low pressure mercury vapor discharge lamp fell within the ambit of claim 1.

3.6 In determining whether a given lamp solves the problem of improved colour rendering, it is clear, for the

reasons explained above under points 2.5 to 2.8, that neither Ra of the CRI nor Qa of the CQS is intended to serve as the metric (three of the six examples have Qa values equal to or worse than those of the comparative examples). According to the description (paragraph [0068]), colour rendering is determined by "a targeted group of individuals", which "reported excellent color rendering ... by the lamps of Examples 1 and 2, compared to illumination by the conventional triphosphor lamp of Comparative Example 1."

3.7 It is questionable whether this method is adequately explained. However, for the purposes of the present discussion, the Board sets aside its doubts on this point, and consequently it would appear to be possible, in principle, to determine whether the problem is solved within the entire claimed range.

Firstly, a significant number of lamps could be manufactured, differing slightly from each other (for example, in types and percentage weights of phosphors), and, using the method proposed in paragraph [0028], their respective locations in the parameter space of delta chroma values for VS1 to VS15 could be determined. The number of lamps should be sufficient to be broadly representative of at least the region of parameter space defined in claim 1.

Secondly, colour rendering tests for each lamp could then be performed in the manner proposed in paragraph [0068] (employing "a targeted group of individuals"), and a comparison made with conventional lamps, thereby determining whether the problem is solved within the borders of the defined region of parameter space.

3.8 There is nothing in the description to indicate that this exercise, or any other procedure with the same aim, was carried out. The description only mentions (in paragraph [0068]) determining whether the problem is solved for three single points of parameter space, namely examples 1 and 2 and comparative example 1, none of which correspond to lamps as defined by claim 1.

As mentioned above, the only described embodiments falling within the ambit of claim 1 appear to be examples 5 and 6, and there is no mention in the description that lamps constructed according to these specifications were checked for their colour rendering.

In summary, not only does the application provide no experimental verification whatsoever that working anywhere within the claimed conditions would provide improved colour rendering, it does not even provide evidence that this effect has been verified for a single example falling within the ambit of claim 1.

3.9 In its communication under Article 15(1) RPBA, the Board drew the appellant's attention to the lack of evidence that claim 1 solved the problem of providing improved colour rendering. The appellant filed no additional evidence or comments of a substantive nature in response.

3.10 Consequently, the Board is not persuaded that the problem of providing improved colour rendering is solved over the breadth of claim 1, and, as a result, this problem cannot serve as the objective problem within the context of the problem-solution approach. In the absence of any other specific problem plausibly solved across the entire breadth of the claim, the

problem can only be seen as merely providing an alternative low pressure mercury vapor discharge lamp.

3.11 In the light of such a general requirement, essentially any conventional modification of the prior art could be seen as an obvious solution to the problem, for example, using different or additional known phosphors, or changing the phosphor weight ratios.

In making these obvious modifications, the skilled person would arrive, without exercising an inventive step, at a wide variety of alternatives, including lamps lying within the ambit of claim 1, for example, lamps which are the same as, or similar to, examples 5 and 6 of the present application.

3.12 In this regard, the Board concurs with the principles established in T 939/92. In that case, the technical effect which, according to the appellant, conferred an inventive step on the claimed subject-matter was herbicidal activity. The deciding Board concluded, however, that it was not satisfied that substantially all the chemical compounds being claimed were herbicidally active (Reasons, point 2.7).

Where the claimed compounds did not (all) have any technically useful property, the Board judged that the technical problem solved by the claimed compounds "would be the minimalist one in such a situation, namely the mere provision of further (or alternative) chemical compounds as such, regardless of their likely useful properties" (Reasons, point 2.5).

3.13 The appellant argued that a particular selection from an "unlimited number of possibilities should be regarded as inventive, even if it was arbitrary, unless

there was a direct pointer to the preparation of [the claimed] compounds in the state of the art" (Reasons, point 2.5.2).

The Board, however, dismissed this argument, on the grounds that, if the result which the skilled person was aiming to achieve was only obtaining further chemical compounds, then, whatever starting point the skilled person selected:

*"all structurally similar chemical compounds, irrespective of their number, that a skilled person would expect, in the light of the cited prior art, to be capable of being synthesised, are equally suitable candidates for solving such a hypothetical 'technical problem', and would therefore all be equally 'suggested' to the skilled person. It follows from these considerations that a mere arbitrary choice from this host of possible solutions of such a 'technical problem' cannot involve an inventive step"* (Reasons, point 2.5.3).

3.14 In the same way, starting from a commercially available triphosphor low pressure mercury vapor discharge lamp, if the problem is merely to find alternative lamps regardless of their likely useful properties, all lamps which could be arrived at by routine modifications (such as using well-known equivalent phosphors or adjusting phosphor weight ratios) would be obvious, irrespective of their number, and this would include embodiments falling within the ambit of claim 1 (for example, the embodiments of examples 5 and 6).

3.15 The Board therefore concludes that the subject-matter of claim 1 of the main request does not involve an

inventive step within the meaning of Articles 52(1) and 56 EPC.

4. *Auxiliary Request: Article 123(2) EPC*

4.1 Claim 1 of the auxiliary request defines a lamp having *inter alia* the following features:

(a) it is a low pressure mercury vapor discharge lamp with a CCT of between 3000 and 4500 K;

(b) the functional requirements on the delta chroma values corresponding to VS1 to VS15, as defined in claim 1 of the main request, are met; and

(c) the red light-emitting element comprises YEO, the green light-emitting element comprises BAMn and the blue light-emitting element comprises BAM.

The question therefore arises whether this combination of features is disclosed at the claimed level of generality in the application as originally filed,.

4.2 According to the appellant, this claim is based on claims 1 and 3 of the main request and "selected features of Claims 6, 7 and 8".

4.3 In the claims as originally filed, the parameter spaces for the claimed inventions are mapped out in terms of the delta chroma ranges for samples VS1 to VS15 in the independent claims (claims 1, 13 and 25), and it is further defined that the red light-emitting element may be selected from a list of five red phosphors, including YEO (claims 6, 18 and 30); the green light-emitting element may be selected from a list of seven green phosphors, including BAMn and LAP

(claims 7, 19 and 31); and the blue light-emitting element may be selected from a list of three blue phosphors, including BAM (claims 8, 20 and 32).

Even if these lists of red, green and blue phosphors are considered to be disclosed in combination (which does not actually follow from the dependencies of the respective claims), feature (c) is not disclosed in the original claims, either in isolation or in combination with features (a) and (b).

4.4 The phosphor lists in paragraphs [0052] and [0053] of the description restate the features of claims 6, 18 and 30 (for red), claims 7, 19 and 31 (for green) and claims 8, 20 and 32 (for blue), and hence these passages also do not provide a basis for claim 1.

4.5 In the description, two embodiments (examples 5 and 6) are defined which fall within the ambit of claim 1 of the auxiliary request, both comprising YEO, BAMn and BAM, but only in combination with many other specific features, as set out in Table XIII (CCT of 3500 K, defined weight percentages of the respective phosphors etc.). Hence, examples 5 and 6 do not provide a basis for the general combination of features (a), (b) and (c).

Examples 1-4 do not disclose feature (a), and also represent specific embodiments (having precisely defined weight percentages of the respective phosphors etc.), which therefore do not provide a basis for the general combination of features (b) and (c).

4.6 The Board therefore judges that claim 1 of the auxiliary request introduces new subject-matter which

was not present in the application as originally filed, contrary to the requirements of Article 123(2) EPC.

4.7 In the light of the above conclusions it is not necessary for the Board to consider, for either request, the Examining Division's objections under Articles 83 or 84 EPC.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated