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**Datasheet for the decision
of 9 April 2019**

Case Number: T 1721/17 - 3.3.10

Application Number: 02724727.9

Publication Number: 1391495

IPC: C09K11/06, H05B33/14, H05B33/22

Language of the proceedings: EN

Title of invention:
ORGANIC ELECTROLUMINESCENCE ELEMENT

Patent Proprietor:
IDEMITSU KOSAN CO., LTD.

Opponents:
DRAGOTTI & ASSOCIATI SRL
Merck Patent GmbH
Hodogaya Chemical Co., Ltd.

Headword:

Relevant legal provisions:
EPC Art. 123(2), 83, 54(2), 56

Keyword:

Amendments - allowable (yes)
Sufficiency of disclosure - (yes)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:



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Case Number: T 1721/17 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 9 April 2019

Appellant: Hodogaya Chemical Co., Ltd.
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted on
3 May 2017 concerning the maintenance of
European Patent No. 1391495 in amended form.

Composition of the Board:

Chairman P. Gryczka
Members: R. Pérez Carlón
F. Blumer

Summary of Facts and Submissions

- I. The appellant (opponent 3) lodged an appeal against the decision of the opposition division concerning the maintenance of European patent No. EP 1 391 495 on the basis of the main request then pending.
- II. Three notices of opposition had been filed on the grounds of added subject-matter (Article 100(c) EPC), insufficiency of disclosure (Article 100(b) EPC), and lack of novelty and inventive step (Article 100(a) EPC). Opponent 1 subsequently withdrew its opposition.
- III. The documents filed during the opposition proceedings include the following:
- D1 Adachi, Kwong and Forrest "Efficient electrophosphorescence using a doped ambipolar conductive molecular organic thin film", Organic Electronics 2 (2001) 37-43,
- D11 US 5,837,166,
- D12 "Organic electroluminescence materials and displays", supervisor: Junji Kido, February 28, 2001, CMC Co., Ltd.

The experimental evidence filed includes the following:

- D13 Experimental report (Hodogaya Chemical Co., Ltd.) dated 31 January 2008, filed as D4 with the appellant's notice of opposition
- D14 Experimental report (Hodogaya Chemical Co., Ltd), dated 19 November 2008, filed as D5 with the appellant's notice of opposition, filed also as D14a not in a language of the proceedings
- D42a Organic Electroluminescence (EL) Devices Experimental Report, dated 2 September 2014, by

Chengdu Geometrical Quantity and Photoelectric Precision Machinery Test Lab of The Chinese Academy of Sciences.

IV. With a letter dated 8 March 2019, the respondent (patent proprietor) filed a main request and first to fourth auxiliary requests, which replaced the requests previously filed. The main request corresponds to the third auxiliary request before the opposition division.

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

"An organic electroluminescence device which comprises a pair of electrodes and an organic medium which comprises at least

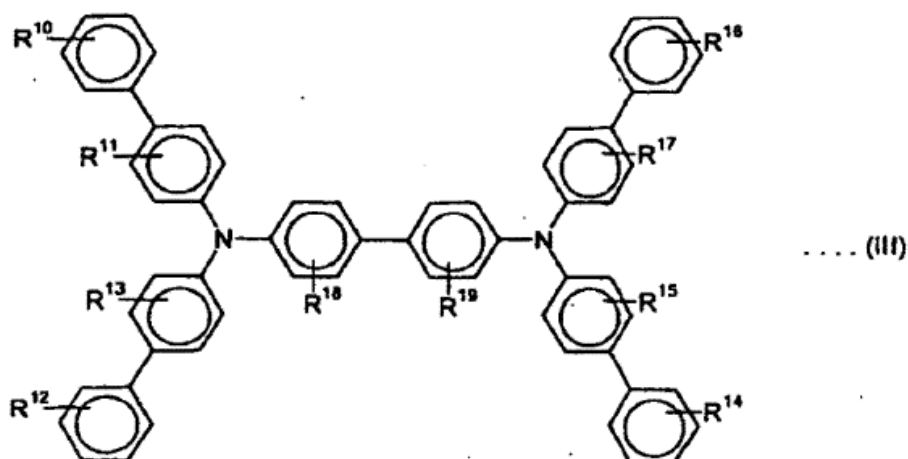
a hole transporting layer comprising a hole transporting material and

a light emitting layer comprising a light emitting material comprising an organometallic complex compound having a heavy metal and is disposed between the pair of electrodes,
wherein

said light emitting material is a phosphorescent light emitting material and wherein the heavy metal is selected from Ir, Pt, Pd, Ru, Rh, Mo and Re,

the hole transporting material comprises an arylamine derivative having no polyacene-based condensed aromatic structures, and

the arylamine derivative is represented by following formula (III):



wherein R^{10} to R^{19} each independently represent hydrogen atom, an alkyl group having 1 to 6 carbon atoms, an alkoxy group having 1 to 6 carbon atoms or a phenyl group, and the atoms or the groups represented by R^{10} to R^{19} may be a same with or different from each other."

VI. The arguments of the appellant where relevant for the present decision were as follows:

Claim 1 of the main request could not find any basis in the combination of claims which were not mutually dependent and thus contained subject-matter going beyond that of the application as originally filed. In addition, the definition of the compounds (III) was restricted with respect to that in the original claims. The combination of this part of compounds (III) with a phosphorescent light emitting material comprising a heavy metal selected from Ir, Pt, Pd, Ru, Th, Mo and Re had also not been disclosed in the application as originally filed.

The claimed invention was not sufficiently disclosed for it to be carried out by the person skilled in the art, as the patent in suit did not provide sufficient information which could allow the skilled reader to

obtain a device according to claim 1 of the main request which had the alleged improved properties.

Document D12 disclosed all the features of claim 1 of the main request. Table 2 of D12 disclosed a compound of formula (III) as hole transporting and the required heavy metal complexes could be found in chapter 11. The claimed device was thus not novel.

Either document D1 or document D11 could be considered as the closest prior art since both documents were suitable springboards for examining the claimed invention. With respect to D1, the experimental evidence on file proved that no improvement had been achieved. The sole problem which could be considered as solved by the claimed device was the provision of an alternative. The solution to this problem, characterised by a hole transporting layer comprising compounds of formula (III), was obvious having regard to D11 and D12. For this reason, the claimed subject-matter was not inventive.

VII. The arguments of the respondent where relevant for the present decision were as follows:

Claim 1 of the main request found a basis in the combination of claim 7 and the sole embodiments disclosed in the application as filed with respect to the metals which were preferably phosphorescent light emitting (page 12, lines 19-21) for the light emitting layer (page 11, line 5-25).

The invention was sufficiently disclosed in the patent in suit. The issue of whether or not the claimed device had any property superior to that of the art did not arise in the context of sufficiency, as such an

improvement was not a feature of claim 1.

Document D12 was an extensive textbook. The elements of the present invention were not disclosed therein in combination, and thus the device of claim 1 of the main request was novel.

Document D1 was the closest prior art for the present invention, and disclosed a phosphorescence device (device II) having a different hole-transporting layer. The problem underlying the claimed invention was to provide a device having improved efficiency in terms of light emission at high luminance. However, even if the problem underlying the claimed invention were to be considered as providing an alternative device having an efficiency of light emission comparable to that of D1, the solution, characterised by a hole transporting layer having a compound of formula (III), was not obvious having regard to the prior art.

- VIII. The party as of right (opponent 2) made no submission during these appeal proceedings, and informed the board that it would not be attending the oral proceedings, which took place on 9 April 2019.
- IX. In a communication in preparation for said oral proceedings, the board informed the parties, inter alia, that it considered the device of claim 1 of each of the requests then pending, which included the device of claim 1 of the main request in these appeal proceedings, to be novel and sufficiently disclosed.
- X. The final requests of the parties were as follows:
- The appellant requested that the decision under appeal be set aside and the patent be revoked.

- The respondent requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request, or on the basis of one of the first to fourth auxiliary requests, all requests filed with a letter dated 8 March 2019.

XI. At the end of the oral proceedings, the decision was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request. Amendments

2. Claim 1 of the main request results from the combination of claims 5, 7, 8 and 10 as originally filed, restricted to compounds of formula (III) from which the possibility that some combinations of residues R¹⁰ to R¹⁹ formed a further ring has been deleted.
3. The appellant argued that, due to the lack of mutual dependency of claims 7, 8 and 9 and to the limitation of formula (III), the claimed subject-matter did not find the required basis in the application as originally filed.
4. Claim 7 as originally filed, dependent on claim 5, discloses an electroluminescent device having a light emitting material comprising an organometallic complex, and having derivatives (III) in the role of hole transporting material.

The skilled reader, seeking further information of the

specific structure of the organometallic complexes suitable for the claimed invention, finds a single passage in the description referring to such compounds, namely that on page 11, lines 5-25. According to this passage, the organometallic complex contains a heavy metal (lines 6-7) such as Ir, Pt, Pd, Ru, Rh, Mo and Re (line 12). No other alternative is disclosed.

Still in the context of these organometallic compounds for the claimed device, page 12, lines 9-21, discloses that it is preferable that the organometallic complex shows emission involving its triplet state (lines 9-10). The material comprising the organometallic complex compound is preferably a phosphorescent light emitting material (lines 19-21).

The patent in suit provides neither further examples of emitting material other than organometallic complexes of the heavy metals required by claim 1, nor emitting mechanisms other than phosphorescence. For this reason alone, the skilled reader would consider these features, disclosed in combination for the reasons explained, to be also combined with the compounds of general formula (III) as disclosed in the combination of claims 5 and 7 as originally filed.

From the compounds of formula (III), the possibility that different rests R^{10} to R^{19} could be bonded to each other in order to form a ring has been omitted. The board fails to see which new information provided by this amendment was not already available to the skilled reader.

Thus, claim 1 of the main request can be derived clearly and unambiguously from the content of the application as originally filed and finds the basis

required by Article 123(2) EPC.

5. The appellant argued that the application as originally filed contained two embodiments, represented by claim 1 and claim 6 as filed. Claim 1 of the main request would result from an arbitrary selection within the first of these embodiments.

However, the board finds the required basis in the passages mentioned in the preceding point. It is irrelevant in this context whether the original application contained one or more independent claims. Further, neither claim 1 nor claim 6 has been taken as the basis required by Article 123(2) EPC for the claimed device.

6. Claim 2 finds a basis in claim 9 as originally filed, and on page 13, lines 5-7. The application as filed does not disclose any other alternative to this embodiment.

Claim 3 finds a basis in claim 11 as originally filed, and on page 13, lines 5-8. As in the previous case, no other alternative to this embodiment is disclosed.

Lastly, claim 4 finds a basis in claim 12 as filed and in the sole list of ligands for the heavy metal required by claim 1, which can be found on page 11, lines 16-25 of the description.

The requirements of Article 123(2) EPC are thus fulfilled.

7. The appellant had no objection under Article 123(3) EPC with respect to the main request, and no objection is

apparent to the board.

Sufficiency of disclosure, main request

8. At the oral proceedings before the board, the appellant relied on its written submissions on the issue of sufficiency of disclosure. Its argument in this respect hinged on whether the skilled reader found sufficient information in the patent in suit in order to obtain a device according to claim 1 with improved properties.

Claim 1 merely relates to a electroluminescence device having a pair of electrodes, a hole transporting layer comprising an amine of formula (III), and a light emitting layer comprising an organometallic phosphorescent complex of Ir, Pt, Pd, Ru, Rh, Mo and Re. It does not require the claimed device to have any specific property over and above being electroluminescent.

The appellant neither argued that the claimed device could not be prepared, nor argued that they would not be electroluminescent. The board does not see any reason why it would not be the case, either.

This argument of the appellant is thus dismissed.

Novelty, main request

9. The appellant had argued in writing, with respect to a request no longer on file, that the electroluminescence device of claim 1 was not novel over the devices of document D12, filed as D12a in the language of the proceedings. This argument applies likewise to the device of claim 1 of the main request.

Document D12 is a textbook, from which only some parts have been filed.

Chapter 9 of D12 discloses light emitting devices (page 1 of D12a, point 2) containing Alq3 as luminescent material and TPD as hole transporting material (see Figure 1). Table 2 (page 8 of D12a onwards) discloses hole transport materials, which include a compound of formula (III) according to claim 1 (TBPB). This passage does not refer to phosphorescent devices, or to the heavy metals required by claim 1.

Only a part of chapter 11 has been filed, which relates to "triplet materials" (point 5; see page 11 of D12a). This passage mentions Ir(ppy)₃, which is a fluorescent heavy metal organometallic complex required by claim 1. However, this triplet material is not disclosed in connection with any specific hole transporting layer.

Thus, document D12a fails to disclose, in combination, the features required by claim 1 of the main request. Claim 1 is thus novel over the prior art opposed to it, as required by Article 54(2) EPC.

Inventive step

10. The claimed invention relates to an electroluminescence device having

- a pair of electrodes and
- an organic medium comprising
 - a hole transporting layer, comprising an arylamine of general formula (III), and
 - a phosphorescent light emitting layer comprising an organometallic complex of Ir, Pt, Pd, Ru, Rh,

Mo and Re.

The claimed invention aims at providing organic electroluminescence devices having high efficiency of light emission at high luminance and small consumption of electricity [0006].

11. Closest prior art

The opposition division and the respondent considered document D1, in particular device II therein, to be the closest prior art.

The appellant argued that not only D1 but also D11 represented a suitable starting point for the assessment of inventive step.

11.1 Document D1 is a scientific article. It discloses high efficiency organic light emitting devices (OLEDs) comprising Ir(ppy)₃ as phosphorescent dopant and different polyaromatic diamines, none of them of general formula (III).

Device II is "a conventional heterostructure device" which contains the following layers:

ITO / alpha-NPD / Ir(ppy)₃:CBP / BCP / Alq₃ / Mg-Ag /Ag

Alpha-NPD has, as the amines of formula (III) required by claim 1, a 4,4'-diamino biphenyl structure. Each amine groups of alpha-NPD is, however, substituted by a phenyl and a naphthyl group instead of by two biphenyl moieties, as required by formula (III). It is not in dispute that this is the sole difference with respect to the device of claim 1.

11.2 Document D11 discloses devices (examples 6 and 7) having an ITO electrode, a diamine of formula (III), a luminescent layer, tris(8-quinolinol)aluminium (Alq) as electron injecting layer, and a magnesium and silver anode. Example 6 of D11 discloses a device with the structure

ITO / compound 3 / DPVBi / Alq / Mg-Al

"Compound 3" is a compound according to formula (III) in which R¹⁰ to R¹⁹ are hydrogen. It is not in dispute that the light emitting layer of D11 does not contain an organometallic complex of the metals required by claim 1.

11.3 Document D1 relates to the same type of devices (phosphorescent light emitting devices), refers to external quantum efficiency and power efficiency (Figure 2), and mentions issues which only arise for this type of devices, such as T-T annihilation (page 38, right-hand column, third full paragraph).

In contrast, D11 does not explicitly refer to phosphorescence and aims at providing organic EL devices having improved life of light emission.

11.4 The appellant argued that both D1 and D11 represented similarly promising springboards, differed from the claimed device by virtue of the structure of one of the layers, and that the application as originally filed related not only to phosphorescent devices but also to fluorescent ones. For these reasons, the examination of inventive step should be carried out with respect to both.

11.5 It is however irrelevant which types of devices were contemplated by the application as originally filed. The subject-matter under examination is the device of claim 1 of the main request, which is phosphorescent.

Since D1 relates to the same type of devices (phosphorescent) as the claimed invention and addresses the issues which are the aim of the claimed invention (efficiency of light emission), it comes closer to the claimed invention and thus represents the closest prior art.

12. Technical problem underlying the invention and solution

The parties had different views as to the formulation of the technical problem effectively solved by the claimed invention.

The respondent defined it as to provide a device having improved efficiency of light emission at high luminance, see [0006] of the patent in suit.

The appellant contested that such problem was solved by the claimed device, arguing that there was no noticeable difference, or a slight improvement at the most, between devices containing alpha-NPD as hole transporting layer and devices containing a compound of formula (III) such as compound 3. It relied in this respect on the evidence filed as D13, D14 and D42a during the opposition proceedings.

The question of whether or not the problem as formulated by the respondent has been solved in all aspects can be left aside, since the board holds that even considering the technical problem to be merely the provision of an alternative electroluminescence device

having comparable efficiency of light emission to that of the prior-art document D1, the proposed solution, namely the claimed device, characterised in that its hole transporting layer comprises an arylamine of formula (III), is not obvious.

13. Success

The appellant has not argued that the problem of providing an alternative electroluminescence device having comparable efficiency of light emission to the devices of document D1 has not been credibly solved by the claimed invention.

The experimental evidence filed by the appellant (D13, D14, D42a) comparing devices containing alpha-NPD, as that of D1, with devices containing compound 3 according to claim 1, leads to the conclusion that said problem has been credibly solved:

- last paragraph of D13 discloses that no difference was noted in the efficiencies of light emission of the prepared organic EL devices;
- document D14, last point, "3. Conclusion" states that "by changing the amine derivative from compound 3 to NPD displayed no difference in current efficiency (efficiency of light emission)", and later on that "the devices [...] showed almost the same current efficiencies in the luminance region of 1-10,000 cd/m²". During the oral proceedings, the appellant confirmed that the last value in column 3 of Table 1 of D14 should read "19" instead of "23", as the corresponding Table in document D14a;

- lastly, document D42a states in point "3. Result analysis" that "in respect of current efficiency, OLED devices using compound 3 as a hole transporting material were slightly better than OLED devices using alpha-NPD as a hole transporting material".

It is thus credible that the problem as defined in point 12. above is solved by the organic electroluminescence device of claim 1.

- 14. It thus remains to be decided whether or not the proposed solution to the objective problem defined above is obvious from the prior art.
- 14.1 The appellant relied on documents D11 and D12a for showing that the claimed solution would have been obvious for the person skilled in the art.
- 14.2 Document D11 discloses compounds of formula (III) as components of hole transporting layers, see examples 6 and 7, whose performance in terms of life of light emission are disclosed in Table 1. Document D11 relates to the problem of life of light emission and driving voltage (paragraph bridging columns 1 and 2), and uses TPD as a reference.

D11 neither relates to efficiency of light emission, nor compares alpha-NPD as hole-transporting layer on any respect.

There is thus no indication in D11 which could have taught the skilled person that the compounds of formula (III) would have a performance comparable to alpha-NPD in terms of efficiency of light emission. This is the case regardless of whether or not the skilled person

would have considered components disclosed in the context of a fluorescent device to have the same properties if used in a phosphorescent device.

- 14.3 Document D12a contains parts of an extensive textbook (over 400 pages according to the index, see page IX of D12). Paragraph 3 of chapter 9 of this document relates to hole transport materials and refers to TPD as the most widely employed hole transport material (page 7, lines 4-5) having $T_g=60^\circ\text{C}$, which has problems regarding life duration due to its low glass transition temperature T_g . It further discloses that investigation and development of hole transporting materials which are aromatic amine-based with high T_g were advancing. Table 2 provides a list of such amines, among which compound 3 according to the invention can be found (TBPB) together with its glass transition temperature $T_g=132^\circ\text{C}$. Alpha-NPD is also in Table 2 and has a $T_g=95^\circ\text{C}$.

Table 1 on page 2 of D12a discloses the properties required for hole transport materials, which are seven in total; T_g is only one of them. This shows that it could not be foreseen whether two compounds would have a comparable performance as hole transport materials by merely having regard at their T_g .

Document D12a would, at the most, disclose compound 3 as a suitable hole transport material but provides no information on whether the efficiency of the light emission of a device containing it would be comparable to that obtained when using alpha-NPD.

- 14.4 The skilled person, trying to obtain an alternative electroluminescence device having an efficiency of light emission comparable to that of the prior art,

finds no pointer in the prior art to the claimed solution.

Since the skilled person would not have any motivation to replace alpha-NPD by a compound of general formula (III) when seeking an electroluminescence device having comparable efficiency of light emission, the claimed solution is inventive within the meaning of Article 56 EPC.

Remittal

15. The description of the patent in the form considered allowable by the opposition division contains subject-matter not encompassed by the claims of the main request in these appeal proceedings (see for example page 4, lines 26-28) and thus requires amendment (Article 84 EPC). The board decides to make use of its discretion to remit the case to the opposition division for the description to be adapted (Article 111(1) EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the claims of the main request as filed with a letter dated 8 March 2019 and a description yet to be adapted.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated