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**Datasheet for the decision  
of 19 March 2015**

**Case Number:** T 1419/12 - 3.3.10

**Application Number:** 03792695.3

**Publication Number:** 1553154

**IPC:** C09K11/06, C07C15/28,  
C07C13/66, H05B33/14

**Language of the proceedings:** EN

**Title of invention:**

ORGANIC ELECTROLUMINESCENCE DEVICE AND ANTHRACENE DERIVATIVE

**Patent Proprietor:**

IDEMITSU KOSAN CO., LTD.

**Opponent:**

Merck Patent GmbH

**Headword:**

ORGANIC ELECTROLUMINESCENCE DEVICE/ IDEMITSU KOSAN

**Relevant legal provisions:**

EPC Art. 56, 84, 123(2)

**Keyword:**

Amendments - added subject-matter (no)  
Claims - clarity - main request (yes)  
Inventive step - main request (yes)

**Decisions cited:**

T 0859/94, T 0615/95

**Catchword:**



**Beschwerdekammern  
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Chambres de recours**

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Case Number: T 1419/12 - 3.3.10

**D E C I S I O N  
of Technical Board of Appeal 3.3.10  
of 19 March 2015**

**Appellant:** Merck Patent GmbH  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
3 May 2012 concerning maintenance of the  
European Patent No. 1553154 in amended form.**

**Composition of the Board:**

**Chairman** P. Gryczka  
**Members:** J.-C. Schmid  
D. Rogers

## Summary of Facts and Submissions

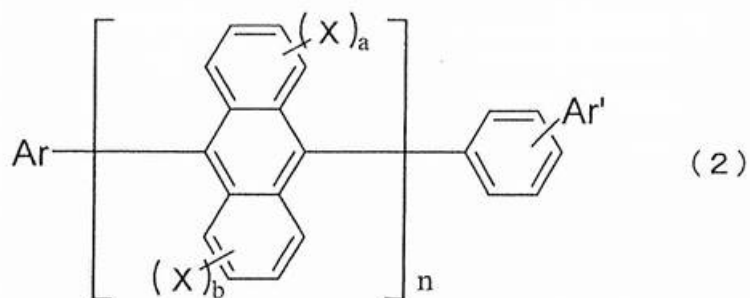
- I. The Appellant (Opponent) lodged an appeal against the interlocutory decision of the Opposition Division which found that the European patent No. 1 553 154 amended according to the then pending auxiliary request 1 met the requirements of the EPC.
- II. Notice of opposition had been filed by the Appellant requesting revocation of the patent in suit in its entirety on the grounds of lack of novelty and inventive step (Article 100(a) EPC) and insufficient disclosure (Article 100(b) EPC). Inter alia the following documents were submitted in the opposition proceedings:
- (1) EP-A-0 857 007,
  - (2) EP-A-1 009 044 and
  - (3) EP-A-1 167 488.
- III. According to the Opposition Division, the specification of the patent-in-suit contained sufficient information to enable the skilled person to carry out the invention across the whole breadth of the claims. Contrary to the assertion of the opponent, the wording "asymmetric anthracene derivative represented by the formula (2)" gave the skilled man the clear teaching that the axis of symmetry was in the direction of the stretched anthracene basis structure. The amended part comprising the wording "asymmetric anthracene derivative" reflected only all the possible substituted asymmetric anthracene structures within the ambit of formula (2). The requirements of Articles 84 and 123(2) EPC were therefore fulfilled for the modified claim 1 according

to the then pending auxiliary request 1. Its subject-matter was also novel over documents (1) and (2). Document (2) represented the closest prior art to the invention. Since there was no comparative example with the structurally closest compound 45 of document (2) the technical problem underlying the patent-in-suit was seen in the provision of alternative asymmetric anthracene derivatives. There was no teaching in document (2) which would have guided the skilled person to modify compound 45 and to select among all possible R3 substituents envisaged by document (2) specifically the Ar' substituents of formula (2) according to the patent-in-suit. The subject-matter of claim 1 of the then pending auxiliary request 1 involved therefore an inventive step.

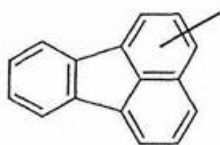
- IV. During the oral proceedings held on 19 March 2015 before the Board, the Respondent (Proprietor of the patent) withdrew its previous requests and defended the maintenance of the patent in suit on the basis of a fresh main request, identical to the then pending auxiliary request 5, and seven auxiliary requests, all requests filed during said oral proceedings.

Claim 1 of the main request read as follows:

"1. An electroluminescence device which comprises a cathode, an anode and an organic thin film layer comprising at least one layer comprising a light emitting layer and disposed between the cathode and the anode, wherein the light emitting layer comprises a light emitting material comprising an asymmetric anthracene derivative represented by following general formula (2):



wherein Ar represents a condensed aromatic group selected from 1-naphthyl group, 2-naphthyl group, 1-anthryl group, 2-anthryl group, 1-phenanthryl group, 2-phenanthryl group, 3-phenanthryl group, 4-phenanthryl group, 1-naphthacenyl group, 2-naphthacenyl group, 9-naphthacenyl group, 1-pyrenyl group, 2-pyrenyl group, 4-pyrenyl group, and



;

Ar' represents an aromatic group selected from phenyl group, 1-naphthyl group, 2-naphthyl group, 1-anthryl group, 2-anthryl group, 9-anthryl group, 1-phenanthryl group, 2-phenanthryl group, 3-phenanthryl group, 4-phenanthryl group, 9-phenanthryl group, 1-naphthacenyl group, 2-naphthacenyl group, 9-naphthacenyl group, 1-pyrenyl group, 2-pyrenyl group, 4-pyrenyl group, 2-biphenylyl group, 3-biphenylyl group, 4-biphenylyl group, p-terphenyl-4-yl group, p-terphenyl-3-yl group, p-terphenyl-2-yl group, m-terphenyl-4-yl group, m-terphenyl-3-yl group, m-terphenyl-2-yl group, o-tolyl group, m-tolyl group, p-tolyl group, p-t-butylphenyl group, p-(2-phenylpropyl)phenyl group, 3-methyl-2-naphthyl group, 4-methyl-1-naphthyl group, 4-methyl-1-

anthryl group, 4'-methylbiphenyl group and 4"-t-butyl-p-terphenyl-4-yl group;

X represents a substituted or unsubstituted aromatic group having 6 to 50 nuclear carbon atoms, a substituted or unsubstituted aromatic heterocyclic group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbon atoms, a substituted or unsubstituted alkoxy group having 1 to 50 carbon atoms, a substituted or unsubstituted aralkyl group having 6 to 50 carbon atoms, a substituted or unsubstituted aryloxy group having 5 to 50 nuclear atoms, a substituted or unsubstituted arylthio group having 5 to 50 nuclear atoms, a substituted or unsubstituted alkoxy carbonyl group having 1 to 50 carbon atoms, carboxyl group, a halogen atom, cyano group, nitro group or hydroxyl group;

wherein the substituents in the group represented by X are selected from halogen atoms, hydroxyl group, nitro group, cyano group, alkyl groups, aryl groups, cycloalkyl groups, alkoxy groups, aromatic heterocyclic groups, aralkyl groups, aryloxy groups, arylthio groups, alkoxy carbonyl groups and carboxyl group,

a and b each represent an integer of 0 to 4; and n represents 1."

- V. According to the Appellant, the only occurrence of the term "asymmetric" in the application as filed was found on page 3, lines 18 and 19 in the wording "a compound having an anthracene structure having a specific asymmetric structure ...". This wording provided no basis for the derivative for being asymmetric. Furthermore, the patent-in-suit lacked a definition for the term "asymmetric". The term "asymmetric" could be interpreted in various manners with the consequence that it was not clear which compounds of formula (2)

could be regarded as being asymmetric and which could not. The derivative of formula (2) as set forth in claim 1 of the main request resulted from selections within various lists of alternatives. Such a combination was not directly and unambiguously derivable from the application as filed. Claim 1 therefore lacked clarity (Article 84 EPC) and contravened the requirement of Article 123(2) EPC. Document (2) was the closest prior art, in particular compound 45 was the closest compound to the derivative of formula (2) of the patent-in-suit. The comparative examples in the patent-in-suit were not carried out with the closest prior compound, and thus did not represent a fair comparison. Therefore the technical problem underlying the patent-in-suit was merely to provide an alternative electroluminescence (EL) device. The anthracene derivatives of formula (2) were contemplated by the generic formula X and XI of document (2). Furthermore, paragraph [0004] on page 1, line 22 to 30 of document (2) taught to the skilled person that the anthracene derivatives which are in the hole-transfer layer can also be placed in the light-emitting layer. Accordingly, the skilled person would have arrived at the solution proposed by the patent-in-suit without the exercise of inventive skill in the light of document (2) alone. Furthermore document (3) taught that similar anthracene derivatives can be used in the light-emitting layer of an EL device, e.g. compound EM21 of document (3), which corresponded to compound 26 of document (2). The skilled person would thus also have arrived at the proposed solution by combining the teaching of document (2) and document (3). Hence the subject-matter of claim 1 of the main request lacked an inventive step with respect to document (2) alone or in combination with document (3).



VI. According to the Respondent, claim 1 of the main request was based upon claim 4 of the patent as granted. The term "asymmetric" was clear in the context of the invention and meant that the anthracene moiety in the formula (2) had two different substituents. According to decision T 615/95 (not published in OJ EPO), a shrinking of lists in a generic formula was not open to an objection under Article 123(2) EPC. Claim 1 of the main request therefore fulfilled the requirements of Article 84 and 123(2) EPC. Document (2) represented the closest prior art. The technical problem underlying the invention was to provide an improved EL device. The anthracene derivatives were described in document (2) as being only usable in the hole-transport layer of an EL device. There was therefore no motivation to select compound 45 of document (2), modify it to arrive at a derivative of formula (2) and use it in a light-emitting layer of an EL device. Document (3) related to anthracene derivatives used in light-emitting layers of EL devices. There was an overlap between the anthracene derivatives of document (3) and those of document (2). However, that did not mean that the compounds of document (2) which did not belong to the overlap could be used in the light-emitting layer of an EL device. The subject-matter of claim 1 involved therefore an inventive step.

VII. 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 that the patent be maintained upon the basis of the Main Request, or alternatively, upon the basis of one of the First to Seventh Auxiliary

Requests, all submitted during the oral proceedings before the board.

VIII. At the end of the oral proceedings, the decision of the Board was announced.

### **Reasons for the Decision**

1. The appeal is admissible.

#### *Main request*

2. *Modifications*

Claim 1 of the main request is based on claim 4 as granted and comprises the additional modifications that Ar does not represent a substituted condensed aromatic group, that the Ar' radical is restricted to the radicals exemplified on page 8, lines 5 to 16 of the application as filed, that the optional substituent(s) of the X radical are specified according to page 21, lines 19 to 23 of the application as filed and that n = 1. Furthermore, the expression "anthracene derivative" was amended into "asymmetric anthracene derivative", based on the disclosure of page 3, lines 18 and 19 of the application as filed.

According to the Appellant, the wording "a compound having an anthracene structure having a specific asymmetric structure ..." found in the application as filed provided no basis for the derivative to be asymmetric. Furthermore, it was not clear which compounds of formula (2) could be regarded as being asymmetric and which could not. Claim 1 therefore lacked clarity (Article 84 EPC) and contravened the requirement of Article 123(2) EPC.

Claim 1 of the main request is directed to an EL device which comprises compounds of formula (2) named "asymmetric anthracene derivative". As can be seen on the representation of formula (2), the anthracene moiety is substituted on the right-hand side by a substituted phenyl radical, and on the left-hand side by an Ar radical, which is a condensed aromatic group, and thus which is different from the substituted phenyl on the right-hand side. All anthracene derivatives exemplified in the application as filed are asymmetrically substituted, while the anthracene derivatives of the comparative examples are symmetrically substituted. It is thus clear that in the context of the present invention the term "asymmetric", which qualifies the derivatives of formula (2), only means that the anthracene moiety of the derivatives is unsymmetrically substituted. In addition, the term "asymmetric" does in fact not introduce any limitation to the compounds of formula (2), since the asymmetric substitution is already reflected in the formula (2) by the definition of the substituent Ar. It is clear for the skilled person that the anthracene derivative as defined in the modified claim 1 is any compound covered by the general formula (2). Accordingly, the contested modification does not introduce any new matter or any lack of clarity into claim 1. Hence, the Appellant's objections with respect to the term "asymmetric" must be rejected.

According to the Appellant, the amended definition of the derivative of formula (2) in claim 1 resulted from multiple selections within various lists of alternatives which was not directly and unambiguously derivable from the application as filed and thus

offended the requirements of Article 123(2) EPC as well.

However, shrinking of the lists of alternatives in the definitions of radicals in formula (2) and defining the index  $n$  as 1 as specifically disclosed in the application as filed, is not objectionable, since these limitations do not result in singling out particular compounds, but maintains the remaining formula (2) as a generic formula differing from the original formula 2 only by its smaller definition (see decisions T 615/95, point 6 of the reasons; T 859/94, point 2 of the reasons, neither published in OJ EPO).

Therefore, the amendments made to claim 1 do not generate new subject-matter extending beyond the content of the application as filed.

The amendments carried out in claim 1 restrict the protection conferred by the patent as granted, which finding was not contested by the Appellant.

Consequently, the Board come to the conclusion that the requirements of Articles 84, 123(2) and (3) EPC are satisfied.

3. *Novelty and sufficiency of disclosure*

Insufficiency of disclosure was raised as a ground for opposition. In the decision under appeal, the Opposition Division found that the invention was sufficiently disclosed. This was not contested by the Appellant in the appeal proceedings. Furthermore, the Appellant did not raise any objection with regard to the novelty of the subject matter of claim 1 of the

fresh main request. Hence, it is unnecessary to go into more detail in this respect.

4. *Inventive step*

4.1 *Closest prior art*

The Board considers, in agreement with the opposition division and the Parties, that document (2) represents the closest state of the art to the invention.

Document (2) describes an electroluminescent device comprising a cathode, an anode, a hole-transport layer and an electron-transport layer which is also the light-emitting layer from which electroluminescence originates (see page 7, lines 15 to 20, figure 1, examples 10 to 16, table I). Preferably the electroluminescent device comprises an electron-transport layer and a separate light-emitting layer (see page 7, lines 21 to 26, page 28, lines 30 to 33; figure 2; examples 17 to 22, table II).

The hole-transport layer of the EL device described in document (2) comprises anthracene derivatives, for example those of formula X and XI disclosed on page 6, lines 30 to page 7, line 1 and on page 21, line 42 to page 22, line 19 of document (2); claims 10 and 11). There is an overlap between the anthracene derivatives generically disclosed in document (2) and those of formula (2) according to the patent-in-suit, namely the anthracene derivative of formula X and XI, wherein  $R^3$  is an aryl group having the meaning of the radicals set forth for the Ar' group in the patent-in-suit and  $R^4$  is a hydrogen atom. Compound 45 which is a compound of formula XI is the closest compound to the compounds of formula (2) of the patent-in-suit. Compared to the

derivatives of formula (2), compound 45 lacks an Ar' substituent on the phenyl group (see document (2) on page 22, lines 25 to 35).

The light-emitting layer of the EL device described in document (2) comprises chelated oxinoid compounds, mix ligand 8-quinolinolato aluminium chelates, such as 8-hydroxyquinoline (Alq) or distyrylstilbene derivatives (see page 28, line 43 to 47; examples 10 to 22, tables I and II).

#### 4.2 *Technical problem underlying the patent-in-suit*

According to the Respondent, the technical problem underlying the patent-in-suit was to provide an improved EL device.

Regardless of the alleged improvements, which are contested by the Appellant, the technical problem to be solved by the invention is, at the least, the provision of a further EL device. The board will therefore consider, in the following discussion, that the technical problem to be solved is the provision of a further EL device.

#### 4.3 *Proposed solution*

The solution proposed by the patent-in-suit is the device of claim 1, characterized by the fact that the therein comprised anthracene derivatives of formula (2) are substituted on the phenyl by an Ar' radical and are placed in the light-emitting layer.

#### 4.4 *Success*

In view of examples 5, 7, 9, 13 and 14 of the patent-in-suit, it is credible that device of claim 1 is an alternative to the EL device known from the closest prior art.

#### 4.5 *Obviousness*

It remains to be decided whether or not the proposed solution to that objective technical problem is obvious in view of the state of the art, i.e. whether it is obvious to the skilled person to modify compound 46 of document (2) to arrive at a derivative of formula (2) and to place the so-modified anthracene derivative into the light-emitting layer instead of the hole transport layer.

Document (2) teaches that the anthracene derivatives of formula X and XI, including compound 45, are in the hole-transport layer of the EL device. There is no indication in that document that they can be placed in the light-emitting layer of the EL device.

According to the Appellant the paragraph [0004] on page 1, line 22 to 30 of document (2) teaches to the skilled person that the anthracene derivatives can also be placed in the light-emitting layer.

This passage of document (2) refers to a prior art electroluminescent device having two layers between the anode and cathode. It is specified in this passage that the hole-transport layer adjacent to the anode is chosen to transport predominantly holes only in the device, that the layer adjacent to the cathode is chosen to transport predominantly electrons only in the device and that EL is produced at the interface or

junction between the hole-transport layer and the electron-transport layer.

Such EL devices having a bi-layer configuration are disclosed in document (2) in paragraph [0015], on page 7, line 15 to 20, in figure 1 on page 41 and exemplified in examples 10 to 16. In these bi-layer EL devices, the electron-transport layer is also the light-emitting layer and the anthracene derivatives are compulsory in the hole-transport layer. Accordingly, paragraph [0004] of document (2) does not teach to the skilled man that the anthracene derivatives of formula X or XI can be displaced from the hole-transport layer into the light-emitting layer.

According to the Appellant document (3) taught that similar anthracene derivatives can be placed in the light-emitting layer, e.g. compound EM21 which is identical to compounds 26 of document (2). It was therefore obvious that the anthracene derivatives disclosed in document (2) could also be placed in the light-emitting layer.

However, compound 26 of document (2) is structurally different from compound 45, it is not even an anthracene derivative of formula X or XI. Hence, document (3) does not suggest that an anthracene derivative of formula X or XI can be placed in the light-emitting layer of an EL device. Hence, document (3) does not provide the skilled person facing the problem of providing an alternative EL device to that of document (2) with the proposed solution using the derivatives of formula (2).



Hence, the subject-matter of claim 1 is not obvious in the light of document (2) alone or in combination with document (3).

The Board is not aware of any further documents cited in the opposition proceedings which render the proposed solution obvious.

Therefore, the Board comes to the conclusion that the subject-matter of claim 1 of the main request, and for the same reason, that according to dependent claims 2 and 3 involve an inventive step within the meaning of Article 56 EPC.

*Auxiliary requests 1 to 7*

Since the main request is considered to be allowable, it is not necessary to decide on the lower-ranking auxiliary requests.

## 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 with the following claims and a description to be adapted:

Claims 1 - 3 of the Main Request, received during the oral proceedings of 19 March 2015.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated