

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 21 July 2022**

Case Number: T 0465/19 - 3.3.10

Application Number: 12863091.0

Publication Number: 2799515

IPC: C09K11/06, C07D307/91,
H01L51/54, H01L51/46

Language of the proceedings: EN

Title of invention:

COMPOUND FOR ORGANIC OPTOELECTRIC DEVICE, ORGANIC LIGHT-
EMITTING DIODE INCLUDING SAME, AND DISPLAY DEVICE INCLUDING
ORGANIC LIGHT-EMITTING DIODE

Patent Proprietor:

Cheil Industries Inc.

Opponent:

Merck Patent GmbH

Headword:

Relevant legal provisions:

EPC Art. 83, 56

Keyword:

Sufficiency of disclosure - (yes)

Inventive step - (yes) - non-obvious alternative

Decisions cited:

T 0939/92

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0465/19 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 21 July 2022

Appellant: Merck Patent GmbH
(Opponent) Frankfurter Strasse 250
64293 Darmstadt (DE)

Representative: Féaux de Lacroix, Stefan
Patentanwälte
Isenbruck Bösl Hörschler PartG mbB
Eastsite One
Seckenheimer Landstrasse 4
68163 Mannheim (DE)

Respondent: Cheil Industries Inc.
(Patent Proprietor) 290 Gongdan-dong
Gumi-si, Gyeongsangbuk-do 730-030 (KR)

Representative: Michalski Hüttermann & Partner
Patentanwälte mbB
Kaistraße 16A
40221 Düsseldorf (DE)

Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 20 December
2018 rejecting the opposition filed against
European patent No. 2799515 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman P. Gryczka
Members: M. Kollmannsberger
F. Blumer

Summary of Facts and Submissions

- I. The opponent's appeal lies from the decision of the Opposition Division to reject its opposition under Article 101(2) EPC.

The appellant had opposed the patent under Article 100(a) EPC for lack of inventive step (Article 56 EPC) and Article 100(b) EPC for insufficient disclosure (Article 83 EPC).

In its decision the Opposition Division held that the claimed invention was sufficiently disclosed (Article 83 EPC) and that neither starting from D1 nor starting from D8 the claimed compounds and light emitting diodes were obviously derivable from the prior art (Article 56 EPC).

- II. The following documents are referred to in this decision:

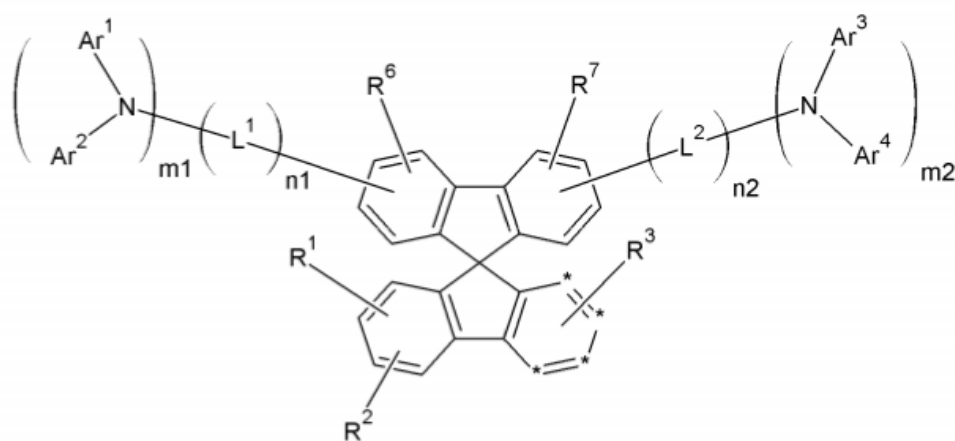
D1: WO2006/122630
D2: Organic Light Emitting Materials and Devices,
Z. Li and H. Meng, CRC Press, 2007 chapter
3.4 "Hole transport materials"
D3: WO2011/116869
D4: WO2006/108497
D5: WO2011/006574
D8: KR20110002156
D8b English translation of D8
D13: EP 2 502 908 A1
D14: EP 2 364 980 A1

D15: WO2011/133007

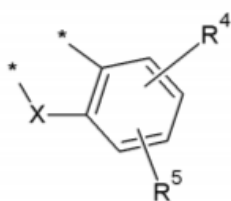
III. Independent claim 1 of the granted patent reads as follows:

"A compound for an organic optoelectronic device represented by a combination of the following Chemical Formula 1 and Formula 2:

[Chemical Formula 1]



[Chemical Formula 2]



wherein, in the above Chemical Formulae 1 and 2,

X is -O-, -S-, -S(O)-, or -S(O)₂-,

Ar¹ to Ar⁴ are independently a substituted or unsubstituted C₆ to C₃₀ aryl group, or a substituted or unsubstituted C₂ to C₃₀ heteroaryl group,

L¹ and L² are independently a single bond, a substituted or unsubstituted C₂ to C₁₀ alkenylene

*group, a substituted or unsubstituted C2 to C10 alkynylene group, a substituted or unsubstituted C6 to C30 arylene group, or a substituted or unsubstituted C2 to C30 heteroarylene group, m1 and m2 are independently integers of 0 or 1, one of m1 and m2 is 1, n1 and n2 are independently integers ranging from 0 to 3, R¹ to R⁷ are independently hydrogen, deuterium, a substituted or unsubstituted C1 to C10 alkyl group, a substituted or unsubstituted C6 to C30 aryl group, or a substituted or unsubstituted C2 to C30 heteroaryl group, and two *s of the above Chemical Formula 2 are bonded with the adjacent two *s of the above Chemical Formula 1 to form a fused ring."*

Dependent claim 8 reads:

"The compound for an organic optoelectronic device of anyone of claims 1 to 7, wherein the compound for an organic optoelectronic device has triplet exciton energy (T1) of greater than or equal to about 2.0 eV."

Independent claims 10 and 15 are directed to devices containing compounds according to claim 1.

The wording of the claims of the auxiliary requests is irrelevant for the present decision.

- IV. With its statement setting out the grounds of appeal and during further appeal proceedings the appellant (opponent) submitted essentially the following:

The decision of the Opposition Division to reject the opposition should be overturned. The claimed invention was not sufficiently disclosed, Article 83 EPC. In particular the claims covered compounds unsuitable for being used in organic light emitting diodes (OLEDs). Furthermore, the claims defined compounds by means of a parameter that has neither shown to be fulfilled nor to be measurable. Moreover, a skilled person could derive the claimed compounds and devices in an obvious manner from the prior art, starting either from D1 or from D8.

The appellant requested the decision of the Opposition Division to be set aside and the patent to be revoked.

- V. With its reply to appeal and during further appeal proceedings the respondent (patentee) submitted essentially the following:

The decision of the Opposition Division was correct. The claimed invention was sufficiently disclosed. Furthermore, starting from either D1 or D8 the claimed compounds and devices were a non-obvious solution to the problem of providing alternative charge transport materials usable in organic electrooptic devices.

The respondent requested the appeal to be dismissed or, failing that, the patent to be maintained on the basis of any one of the following auxiliary requests:
auxiliary requests 1A and 1B, filed with letter dated 8 July 2022;
auxiliary requests 1 to 5, filed with letter dated 31 March 2022.

- VI. The parties' arguments relevant for the present decision are dealt with in detail in the reasons for the decision below.
- VII. With notification of 1 October 2021 the parties were summoned to oral proceedings. On 31 January 2022 the Board issued a communication pursuant to Article 15(1) RPBA 2020 in which the parties were informed about the issues to be discussed at oral proceedings as well as a provisional opinion of the Board on the disputed issues. In the preliminary opinion of the Board the Opposition Division's decision was correct.
- VIII. Oral proceedings took place on 21 July 2022.

At the end of the oral proceedings the chairman announced the decision.

Reasons for the Decision

1. The appeal is admissible
2. Sufficiency of disclosure (Article 83 EPC)
 - 2.1 The Opposition Division decided that the claimed invention is sufficiently disclosed (point 3 of the decision). The Board agrees, for the reasons set out below. The two lines of argumentation forwarded by the appellant are not convincing.

2.2 The first point the appellant raised relates to compounds having certain groups which may be substituted or unsubstituted, as defined in the claims. This applies in particular for the definitions of L¹/L² and R¹-R⁷. In the appellant's view this definition also covers substituents making the compounds unsuitable for use in OLEDs, e. g. thermally labile or ionizable groups. Thus, in his view the claims cover non-working embodiments.

However, the patent discloses general formulae and many examples of suitable compounds. Also the meaning of "substituted" is defined in [0044] and [0045].

Individual non-working embodiments, as alleged by the appellant, are generally no proof of an insufficient disclosure of the invention as long as a skilled person knows how working embodiments can be obtained. This is clearly the case here.

Moreover, claim 1 of the patent relates to a compound "*for an organic optoelectronic device*". Hence, the claim covers only compounds which are suitable for being used in an organic optoelectronic device. Compounds which can be recognized by a skilled person to be unsuitable, such as the compounds bearing substituents mentioned in the appellant's argument, are not covered by the claims anyway.

2.3 Secondly, the appellant submitted that claim 8 lacked sufficient disclosure since the patent neither contained (i) any example of a compound having a triplet exciton energy (T1) of at least 2.0 eV nor (ii) any disclosure of how this parameter can be measured.

The Board notes that the patent states in [0083] that the compounds of the invention have a high T1 value of

at least 2.0 eV. The appellant has provided neither technical arguments nor data showing that this is not the case. Determination of T1 energies by optical spectroscopy, e. g, by measuring the phosphorescence spectra, is general practise.

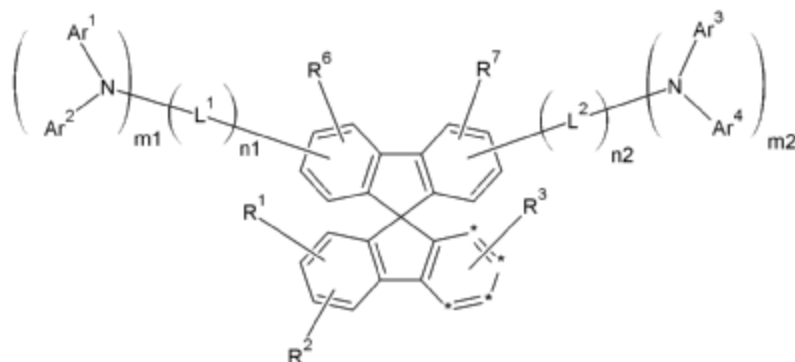
Thus, the appellant has not shown that a skilled person would be unable to obtain a compound as defined in claim 8.

2.4 The claimed invention is sufficiently disclosed.

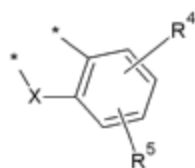
3. Inventive step (Article 56 EPC)

3.1 The patent deals with compounds being useful in organic light emitting devices (OLEDs) and having emitting as well as charge transporting properties, see e. g. [0019] or [0083] of the patent. The compounds should have a high glass transition temperature to stabilize the amorphous state and avoid crystallisation, see [0085]. Thermal stability contributes to a higher life span, see [0063].

The claims are directed to compounds of the following structure:



[Chemical Formula 2]

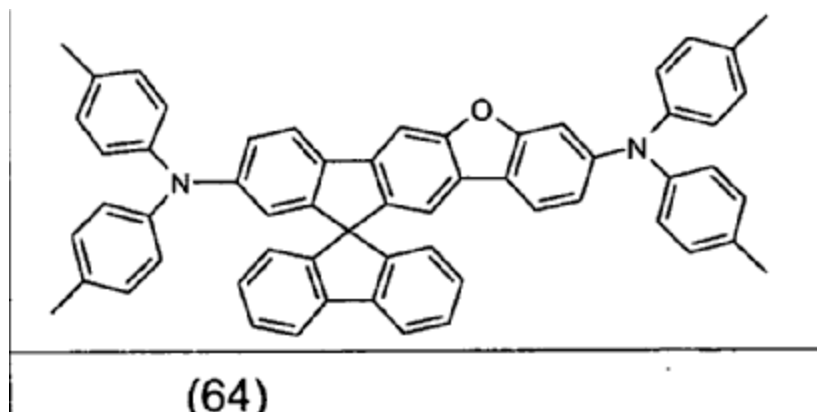


In this formula X is O or S and at least one of m1 and m2 is 1, so that the central spirofluorene has a condensed benzofuran/benzothiophene structure on one side and at least one arylamino substituent on the other side.

- 3.2 In the impugned decision D1 and D8 were cited as starting point for the inventive step analysis. Both these documents deal with charge transporting materials used in OLEDs. The compounds of D1 are said to have a high thermal stability leading to increased efficiency and life time of the OLEDs, see pages 30/31. Also the compounds of D8 are said to have these advantages, see [0081] to [0083] of the translation D8b. D8 specifically relates to the high glass transition temperature of the compounds disclosed therein, see [0083].

D1 as closest prior art

3.3 D1 discloses as structurally closest compound compound (64), having the following structure:



The patent claims differ from compound (64) of D1 in that the triarylamino groups must be attached, possibly via the unsaturated spacers L^1/L^2 , to the part of the spirobifluorene not containing the condensed benzofurane moiety. The claims do not allow amino groups directly attached to the benzofurane condensed fluorene part.

This was undisputed.

3.4 No improvements re D1 have been established.

Thus, the technical problem to be solved starting from D1 was the provision of alternative compounds that could be used as charge transport materials used in OLEDs.

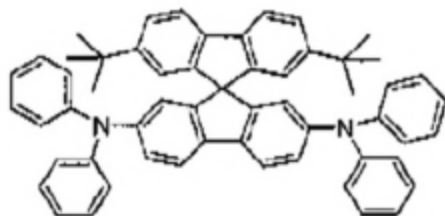
This was likewise undisputed; during oral proceedings the parties agreed on the problem being formulated as an alternative.

3.5 It was undisputed that this problem has been solved by the claimed compounds. The dispute is whether the

claimed solution was obvious. Thus, it must be decided if a skilled person would have seen the claimed compounds as a solution to this problem, i. e. as an alternative charge transport material used in OLEDs.

The appellant presented different lines of arguments.

- 3.5.1 It was referred to D2. D2 is a textbook on OLEDs and contains a chapter dealing with hole transport materials. Compound (43) of D2 is presented as a hole transport material leading to high luminescent activities. Compound (43) has the following structure:



In the appellant's view this compound showed that a skilled person knew that arylamino groups could also be directly attached to the spirobifluorene part while maintaining a substituent, in this case a t-butyl group, on the other ring. Such a basic structure was known to be suitable for the claimed purpose. A skilled person, looking for alternatives, would thus have modified compound (64) of D1 by attaching the amino groups at the part of the spirobifluorene not containing the condensed benzofurane moiety.

However, the Board considers this argument to be based on hindsight.

Apart from compound (64) in D1 none of the many other compounds disclosed in D1 or D2 has a condensed benzofurane moiety. The respondent submitted, and the

Board agrees that a skilled person, when starting from compound (64) of D1 would have rather learnt from D2 that the benzofurane moiety is superfluous and could be left out. A skilled person is not taught by D2 that maintaining this moiety while changing the position of the arylamino substituents will lead to usable alternative structures.

- 3.5.2 The appellant argued that a skilled person knew from common general knowledge that it was enough for any compound to contain covalently linked spirobifluorene and triaryl amine units in order to be useful for applications in an OLED. It was referred to page 317 of D2 which states that spiro-shaped hole transport materials have been extensively studied and the spiro structure improves the thermal stability of the amorphous state. In addition to to compound (43) mentioned there it was referred to compound (32) of D5 and compound I-4-19 of D8.

However, from this passage in D2 it cannot be concluded that any compound having a spirobifluorene unit and arylamino groups attached thereto was suitable as a hole transport material. The nature of the covalent bonding and/or specific substitution patterns will generally influence the suitability of a compound for this purpose. Changing the electronic structure by modifying substituents influences the energy levels responsible for charge transport and emission. Applied to the present case, a skilled person would not have concluded from the disclosure of the D2, based on compounds differing in other parts of the molecule, that the positioning of the arylamino groups in the molecule is of no importance. That compound (43) is cited in other publications and has become a standard hole transport material, as brought forward by the

appellant, does not change this assessment. Even if so, a skilled man would still not have arrived at the present claims when starting from Compound (64) of D1 and considering compound (43) of D2.

The appellant likewise referred to page 4, lines 15-26 of D3. In the appellant's view, this passage discloses the general usability of compounds having spirobifluorene skeleton and arylamino groups as hole transport layers in OLEDs. However, this passage clearly relates to the invention disclosed in D3; the respective compounds are defined at the beginning of the following page 5. D3 does not represent common general knowledge.

- 3.5.3 The appellant cited the decision T 939/92 for the present situation. The appellant argues that, since all cited documents relate to compounds useful in optoelectronic devices and show the structural elements of the claimed compounds the fact that the claimed ones also have such properties was by no means particular or surprising.

It is correct that T 939/92 held the provision of compounds without any particular properties, just for the enrichment of chemistry, to be routine work of a chemist and thus not to require any inventive activity.

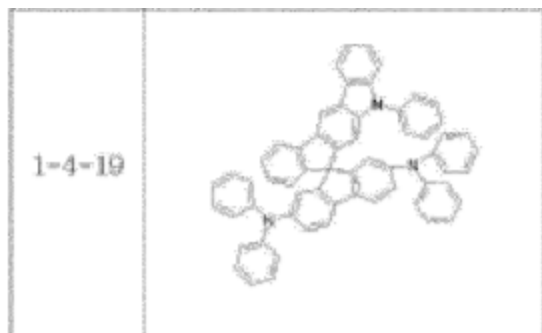
However, in the present case the claimed compounds do have useful properties and are not just provided for the enrichment of chemistry. This situation is different to the situation underlying T 939/92. Unlike there, the present compounds need to be suitable for the claimed use. Thus, inventive step may not already be denied for the only reason that the compounds have the same, or similar, properties as the compounds

disclosed in the prior art. Alternative solutions for the same technical problem may still be validly claimed, provided that they do not obviously result from the teaching of the prior art.

3.5.4 Thus, starting from D1 the claimed compounds are a non-obvious solution to the stated problem.

D8 as closest prior art

3.6 D8 discloses as structurally closest compound 1-4-19, having the following structure:



The patent claims differ from compound 1-4-19 of D8 in that in the condensed fluorene part they require an oxygen or sulfur atom instead of the phenyl substituted nitrogen atom.

This was undisputed.

3.7 No improvements re D8 have been established.

Thus, the technical problem to be solved starting from D8 was the provision of alternative compounds that could be used as charge transport materials used in OLEDs.

This was likewise undisputed.

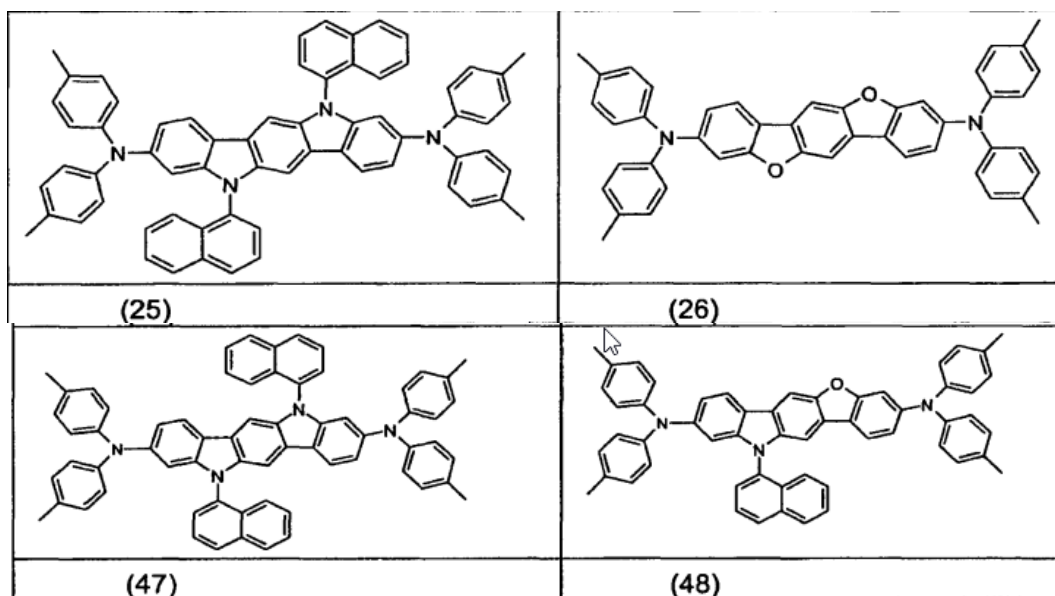
3.8 It was undisputed that this problem has been solved by the claimed compounds. The dispute is whether the claimed solution was obvious. Thus, it must be decided if a skilled person would have seen the claimed compounds as a solution to this problem, i. e. as an alternative charge transport materials used in OLEDs. Starting from D8 a skilled person would have had to replace the nitrogen atom in the condensed system by an oxygen or sulfur atom.

3.9 The appellant argued that the replacement of the nitrogen by oxygen or sulfur atoms was obvious from D8 itself as well as from other cited documents, like D1, D4 or D13-D15.

However, none of these documents shows the equivalence of condensed benzofuranes or benzothiophenes in aryl amino substituted systems as claimed with the indole structure of D8.

It is correct that according to claim 4 of D8 additional heteroatoms may be present, however, at least one nitrogen atom is obligatory, unlike in the present claims. In all other documents cited (compound 54 of D4, D13-15) the amino groups are located on the "wrong" part of the spirobifluorene structure. Compound 43 of D2, which was also referred to, is a spirobifluorene without any further condensation.

The appellant additionally referred to compounds 25/26 and 47/48 of D1, which have the following structure:



However, while these examples show that in certain structures oxygen atoms and arylamines are exchangeable, they do not relate to spirocondensed systems. This disclosure cannot simply be transferred to compound I-4-19 of D8.

Thus, the cited documents do not show an equivalence of the condensed indole of D8 and the claimed condensed benzofurane or benzothiophene compounds.

3.10 Also starting from D8 the claimed compounds are a non-obvious solution to the stated problem.

4. None of the grounds of opposition invoked by the appellant prejudices the maintenance of the patent as granted. The decision of the Opposition Division to reject the opposition under Article 101(2) EPC was correct. The respondent's auxiliary requests need not be addressed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated