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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/288,769	11/28/2005	Ja-Hyun Im	56414/S1082	7676

23363 7590 01/31/2013
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ART UNIT	PAPER NUMBER
2889	

MAIL DATE	DELIVERY MODE
01/31/2013	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte JA-HYUN IM, KWAN-HEE LEE, and SEOUNG-YOON RYU

Appeal 2010-007112
Application 11/288,769
Technology Center 2800

Before JOHN A. JEFFERY, DENISE M. POTHIER, and
JEREMY J. CURCURI, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1, 2, 6-14, and 18-26. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants' invention is an organic light emitting diode (OLED) display with an organic capping layer formed on an electrode. The capping layer is 600 Å thick and has a refractive index of at least 1.7 which maximizes luminal efficiency and minimizes power consumption. *See*

generally Abstract; Spec. ¶¶ 0061, 0063; Figs. 4-6. Claim 1 is illustrative with key disputed limitations emphasized:

1. An organic light emitting diode (OLED) display comprising:

a substrate;

a first electrode formed on the substrate, the first electrode including a reflecting layer;

an organic layer formed on the first electrode, the organic layer including an organic emission layer;

a second electrode formed on the organic layer; and

an organic capping layer having a thickness of 600 Å formed on the second electrode, the organic capping layer having a refractive index of at least 1.7 and configured to transmit light from the organic layer.

THE REJECTIONS

1. The Examiner rejected claims 1, 13, and 26 under 35 U.S.C. § 103(a) as unpatentable over L.S. Hung et al., *Application of an Ultrathin LiF/Al Bilayer in Organic Surface-emitting Diodes*, 78 Appl. Phys. Lett. 544 (2001) ("Hung"). Fin. Rej. 3-4; Ans. 3-4.[1]

2. The Examiner rejected claims 6, 18, and 25[2] under 35 U.S.C. § 103(a) as unpatentable over Hung and Aziz (US 2006/0022590 A1; Feb. 2, 2006; filed Aug. 2, 2004). Ans. 4-5.

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[1] Throughout this opinion, we refer to (1) the Final Rejection mailed January 27, 2009 ("Fin. Rej."); (2) the Appeal Brief filed August 17, 2009 ("Br."); and (3) the Examiner's Answer mailed December 10, 2009 ("Ans.").

[2] Although the Examiner omits claim 25 from the rejections, both Appellants and the Examiner acknowledge its rejection. *See* Br. 1 (noting that the Examiner rejected claims 18-26 in the status of the claims section); Ans. 3

3. The Examiner rejected claims 1, 2, 7-14, and 19-24[3] under 35 U.S.C. § 103(a) as unpatentable over Uchida (US 2004/0061121 A1; Apr. 1, 2004) and Hung. Ans. 5-7.

THE OBVIOUSNESS REJECTION OVER HUNG

The Examiner finds that Hung's OLED display has every recited feature of representative claim 1 except for the organic Alq[4] capping layer to be 600 Å thick, but rather 509 Å and 520 Å in two examples with a refractive index of 1.7. Ans. 3-4, 7-12. Despite this difference, the Examiner nonetheless concludes that it would have been obvious to optimize the capping layer's thickness to the recited 600 Å for optimal light transmission. Ans. 3-4, 7-12.

Appellants argue that since transmittance increases as refractive index increases from 1.7 for correspondingly thinner materials in Hung's Table II, Hung teaches away from thickening the Alq capping layer to 600 Å as the Examiner proposes. Br. 5-9. Appellants add that the recited 600 Å capping layer thickness is critical and achieves unexpected results as evidenced by the comparative efficiency and power consumption measurements noted in a declaration from one of the inventors. Br. 9-10.

(confirming this status as correct). We therefore presume that the Examiner intended to reject claim 25 over Hung and Aziz since claim 25 depends from claim 6 which, like claim 1, was rejected based on Hung.

[3] Although the Examiner erroneously includes cancelled claims 5 and 17 in this rejection, we omit them here and present the correct claim listing for clarity.

[4] "Alq" stands for Tris-(8-hydroxyquinoline) aluminum. Hung at 544.

ISSUE

Under § 103, has the Examiner erred in rejecting claim 1 by finding that it would have been obvious to optimize Hung's capping layer thickness to 600 Å as claimed?

ANALYSIS

We begin by noting that it is undisputed that Hung discloses an organic Alq capping layer with 509 Å and 520 Å thicknesses in two respective examples with a refractive index of 1.7. Ans. 8-9 (citing these examples on Hung's p. 546). Although Hung is silent regarding the recited 600 Å thickness, we agree with the Examiner that it would have nonetheless been obvious to optimize Hung's capping layer to that thickness.

It is well settled that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller*, 220 F.2d 454, 456 (CCPA 1955). But a particular parameter must first be recognized as a result-effective variable (i.e., a variable that achieves a recognized result) before determining whether the variable's optimum or workable ranges can be characterized as routine experimentation. *See In re Antonie*, 559 F.2d 618, 620 (CCPA 1977).

First, we find that capping layer thickness is a result-effective variable since its thickness affects light transmission. *See* Hung at 546 (noting that layer thickness is chosen for optimal light transmission); *see also id.* (noting that transmittance is strongly dependent on refractive indices and *layer thicknesses* of index matching material as shown in Table II).

Second, despite Appellants' arguments to the contrary, we see no reason why Hung's Alq layer thickness could not be optimized to 600 Å as the Examiner proposes. Notably, both of Hung's cited examples pertain to particular cathode stack structures with the same refractive index (1.7), but have different layer thicknesses, including the LiF, Al, and Ag layers that are common to both examples. *See* Hung at 546. This structural distinction perhaps explains the difference between the *optimal* Alq layer thicknesses (52 nm versus 50.9 nm) in these respective examples. While these Alq layer thicknesses may be optimal in those particular configurations, that hardly means that these thicknesses would be optimal for other such configurations.

Although transmittance increases as refractive index increases from 1.7 for correspondingly thinner materials in Hung's Table II as Appellants contend (Br. 5-9), we disagree with Appellants that Hung teaches away from thickening the *organic Alq* capping layer to 600 Å to optimize light transmission for a particular OLED structure. As the Examiner indicates (Ans. 8-10), the materials cited by Appellants as supporting a trend to higher refractive indices and transmittances with thinner materials in Hung's Table II pertains to *inorganic*—not organic—materials, namely ITO, ZnO, and TiO_2. These inorganic materials are irrelevant to the Examiner's position that is based on optimizing the *organic Alq* capping layer to 600 Å for optimal light transmission given a particular OLED structure.

Nor are we persuaded that the submitted declaration from one of the inventors, Ja-Hyun Im, persuasively rebuts the Examiner's obviousness conclusion. To be sure, Appellants' comparative measurements in Figures 4 through 6 of the present application indicate that a 600 Å organic capping layer thickness maximizes red (R) and green (G) light efficiency and

minimizes blue (B) light power consumption. Spec. ¶¶ 0061, 0063; Figs. 4-6; *Accord* Im Decl. But despite this apparently unexpected result (Br. 9-10; Im Decl. 2), these particular color-based efficiencies and power consumption features are not claimed as the Examiner indicates. Ans. 11. In any event, we cannot say that it would not have been obvious to optimize the thickness of Hung's organic capping layer to 600 Å as the Examiner proposes, for Appellants have not persuasively demonstrated that this particular thickness does not merely result from a routine optimization of a result-effective variable well within the level of ordinarily skilled artisans.

While the recited 600 Å thickness may be optimal regarding the particular RGB luminal efficiency and power consumption aspects noted above, to say that this thickness value is critical as the inventor contends (Im Decl. 2) is undercut by Appellants' Specification which notes that "other suitable thicknesses may be used for the organic capping layer, as disclosed herein." Spec. ¶ 0063. Notably, Appellants indicate that organic capping layers with thicknesses from 300 Å to 900 Å can be used to increase RGB luminal efficiencies and minimize power consumption. Spec. ¶¶ 0032-33.[5]

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[5] Claim differentiation principles further undercut the criticality of the recited 600 Å thickness. Notably, Appellants' claim 25 recites this thickness, but independent claim 6—from which claim 25 depends—does not. Surely, Appellants envisioned some thickness other than 600 Å would satisfy the requirements of the recited OLED—otherwise claim 25 would be superfluous. *Free Motion Fitness, Inc. v. Cybex Int'l, Inc.*, 423 F.3d 1343, 1351 (Fed. Cir. 2005) ("The doctrine of claim differentiation creates a presumption that each claim in a patent has a different scope . . . . The difference in meaning and scope between claims is presumed to be significant to the extent that the absence of such difference in meaning and scope would make a claim superfluous.") (internal quotation marks and citations omitted).

That Hung's organic capping layer thickness of 509 Å and 520 Å in both cited examples falls well within Appellants' range only further bolsters the Examiner's position that it would have been obvious to optimize the disclosed thickness to 600 Å.

We are therefore not persuaded that the Examiner erred in rejecting representative claim 1, and claims 13 and 26 not separately argued with particularity.[6]

THE OBVIOUSNESS REJECTION OVER HUNG AND AZIZ

The Examiner finds that Hung has every feature of representative claim 6 except for an organic capping layer formed of an arylenediamine derivative and/or CBP, but cites Aziz as teaching a CBP organic capping layer in concluding that the claim would have been obvious. Ans. 4-5, 10-11.

Appellants argue that there is no reason to use Aziz's anode capping layer material in Hung since it is used for an unrelated purpose, namely as a hole transport material that is conventionally placed on either side of an organic light emitting layer. Br. 10-11.

[6] Although the Examiner cites an additional reference (Xie) in connection with this rejection, we do not consider it here for it was not cited in the rejection. *See In re Hoch*, 428 F.2d 1341, 1342 n.3 (CCPA 1970) ("Where a reference is relied on to support a rejection, whether or not in a 'minor capacity,' there would appear to be no excuse for not positively including the reference in the statement of the rejection.").

ISSUE

Under § 103, has the Examiner erred in rejecting claim 6 by finding that Hung and Aziz collectively would have taught or suggested a CBP organic capping layer? This issue turns on whether the Examiner's combining the teachings of these references is supported by articulated reasoning with some rational underpinning to justify the Examiner's obviousness conclusion.

ANALYSIS

We will sustain the Examiner's rejection of representative claim 6 for the reasons indicated by the Examiner. Ans. 12-13. As the Examiner indicates (Ans. 12-13), Aziz's anode capping layer is used for a related function, namely light transmission—a function that is not limited to solely OLED anodes as Appellants seem to suggest. *See* Aziz ¶ 0058 (noting that the OLED's anode *and/or* cathode sides may be light transmissive). Although the material that the Examiner identifies as CBP in Aziz's Paragraph 82 (4'4'-bis(9-carbazolyl)-1,1'-biphenyl) pertains to a particular hole transporting material in connection with the device's light emitting region (*see* Aziz ¶¶ 0065-66), Appellants have not persuasively shown why CBP could not be used as an organic capping layer as the Examiner proposes—an enhancement that predictably uses prior art elements according to their established functions—an obvious improvement. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 417 (2007). That particular layers in Aziz's OLED structure are not limited to the designated regions (e.g., light-emitting and anode-capping regions) and can be a part of any region (Aziz ¶ 0056) only bolsters this conclusion.

We are therefore not persuaded that the Examiner erred in rejecting representative claim 6, and claims 18 and 25 not separately argued with particularity.

THE OBVIOUSNESS REJECTION OVER UCHIDA AND HUNG

We also sustain the Examiner's rejection of claims 1, 2, 7-14, and 19-24 over Uchida and Hung (Ans. 5-7) since Appellants rely on arguments similar to those for the rejection of claim 1 over Hung alone (*see* Br. 5-10), which we find unpersuasive for the reasons noted previously.

CONCLUSION

The Examiner did not err in rejecting claims 1, 2, 6-14, and 18-26 under § 103.

ORDER

The Examiner's decision rejecting claims 1, 2, 6-14, and 18-26 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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