

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte XIAO-AN ZHANG,
R. STANLEY WILLIAMS
and YONG CHEN

Appeal 2007-4330
Application 10/420,565
Technology Center 1700

Decided: December 13, 2007

Before CHUNG K. PAK, CHARLES F. WARREN, and THOMAS A.
WALTZ, *Administrative Patent Judges*.

PAK, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. § 134 from the Examiner's final rejection of claims 1 through 31, 34 through 37, 39 through 44, 46, and 47, all of the claims pending in the above-identified Application. We have jurisdiction pursuant to 35 U.S.C. § 6.

STATEMENT OF THE CASE

The subject matter on appeal is directed to “the fabrication of electronic and opto-electronic circuits” (Spec. 1, para. 0001). Further details of the appealed subject matter are recited in representative claims 1 and 47 reproduced below:

1. A method for printing circuits selected from the group consisting of electronic circuits and opto-electronic circuits, said method comprising:

providing a substrate onto which at least one said circuit will be formed;

providing a film-forming precursor species;

forming a substantially uniform and continuous film of said film-forming precursor species onto a surface of said substrate, said film having a first electrical conductivity;

printing at least one conductivity-altering species on portions of said film to form regions having a second electrical conductivity that is of a different value than that of said first electrical conductivity, but of the same conductivity type, said regions thereby providing circuit elements for said circuits, wherein said printing is performed by a process including passing said film-coated substrate over a patterned mechanism such that said patterned mechanism contacts said film with a first conducting state, wherein said patterned mechanism is selected from the group consisting of (a) patterned rollers, (b) ink jet patterning, (c) mold patterning, and combinations thereof, said patterned mechanism having a predetermined pattern of at least one electrical conductivity-altering species thereon, said predetermined pattern being transferred to said film to form said regions of a second conductivity; and

driving said at least one conductivity-altering species into said regions of said film to thereby provides said regions in said layer having said second electrical conductivity.

47. A method for printing circuits selected from the group consisting of electronic circuits and opto-electronic circuits, said method comprising:

providing a substrate onto which at least one said circuit will be formed;

providing a film-forming precursor species;

forming a substantially uniform and continuous film of said film-forming precursor species onto a surface of said substrate, said film having a first electrical conductivity;

printing at least one conductivity-altering species on portions of said film to form regions having a second electrical conductivity that is of a different value than that of said first electrical conductivity, but of the same conductivity type, said regions thereby providing circuit elements for said circuits, wherein said printing is performed by a process including passing said film-coated substrate over an inkjet patterned mechanism such that said inkjet patterned mechanism contacts said film with a first conducting state, said inkjet patterned mechanism having a predetermined pattern of at least one electrical conductivity-altering species thereon, said predetermined pattern being transferred to said film to form said regions of a second conductivity; and

driving said at least one conductivity-altering species into said regions of said film to thereby provide said regions in said layer having said second electrical conductivity.

The Specification defines the claimed film-forming precursor species as including “polymeric substances...an exemplary list...but not limited to, polyaniline...,” (p. 7) and the claimed at least one conductivity-altering species as including “appropriate dopant species” (p. 4). Indeed, the Specification at pages 6 and 7, for example, further explains that:

In the positive printing method, a non-electrically-conducting thin film of at least one undoped "active precursor", which may be a polymeric species or a small molecular species,

is formed on a polymer web, or substrate. As used herein, the term "small" with reference to "molecule" means a single or mixed molecule, including an oligomer, with less than 100 atoms in its structure, for which the structure can be trivially determined using x-ray or NMR techniques, as is conventional.

....

Following formation of the thin film, portions of the thin film are next printed with a dopant to form doped regions in the thin film that have a second electrical conductivity. The doped portions are formed in a predetermined pattern to provide various circuit elements, as discussed above. The second electrical conductivity is at least two orders of magnitude greater than that of the first electrical conductivity.

As is apparent from the above passage of the Specification, as well as page 8, paragraph 0033, of the Specification, the claimed "driving said at least one conductivity-altering species into said region of the said film" encompasses doping either polymeric or molecular thin films with a dopant. According to page 4 of the Specification, "[t]he printing process can be performed by *conventional* xerographic procedures, by laser printing, ink jet printing (e.g., solid jet, bubble jet, piezo jet, etc.) by contact printing, or by a combination of these techniques...[emphasis added]."

As evidence of unpatentability of the claimed subject matter, the Examiner has relied upon the following references:

Yaniger	4,822,638	Apr. 18, 1989
Barry, Jr.	5,176,851	Jan. 5, 1993
Schoch, Jr.	5,250,388	Oct. 5, 1993
Angelopoulos	5,300,208	Apr. 5, 1994
Lawrence	2003/0151028 A1	Aug. 14, 2003

The Examiner has rejected the claims on appeal as follows:

1. Claims 1, 2, and 47 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Yaniger, Lawrence, and Barry, Jr.;
2. Claims 3 through 22 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Yaniger, Lawrence, Barry, Jr., and Angelopoulos; and
3. Claims 23 through 31, 34 through 37, 39 through 44, 46, and 47 under 35 U.S.C. § 103(a) as unpatentable over the combined disclosures of Yaniger, Lawrence, Barry, Jr., Angelopoulos and Schoch.

The Appellants appeal from the Examiner's decision rejecting the claims on appeal under 35 U.S.C. § 103(a).¹

PRINCIPLES OF LAW, FACTS, ISSUES and ANALYSES

Under 35 U.S.C. § 103, the factual inquiry into obviousness requires a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations (e.g., unexpected results). *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17-18 (1966). “[A]nalysis [of whether the subject matter of a claim would be obvious] need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *KSR Int’l v. Teleflex, Inc.*, 127 S. Ct. 1727, 1740-41 (2007),

¹ We limit our discussion to claims 1, 3, 23, 34, 35, 41, 44, and 47 consistent with 37 C.F.R. § 41.37(c)(1)(vii) (2005).

quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006), see also *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006) (“The motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself.”); *In re Bozek*, 416 F.2d 1385, 1390 (CCPA 1969) (“Having established that this knowledge was in the art, the examiner could then properly rely, as put forth by the solicitor, on a conclusion of obviousness ‘from common knowledge and common sense of the person of ordinary skill in the art without any specific hint or suggestion in a particular reference.’”). “When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product . . . of ordinary skill and common sense.” *KSR Int’l v. Teleflex, Inc.*, 127 S. Ct. at 1742.

CLAIMS 1, 2, AND 47:

As evidence of obviousness of the subject matter defined by claims 1, 2, and 47 under 35 U.S.C. § 103(a), the Examiner has relied on the combined disclosures of Yaniger, Lawrence, and Barry, Jr. The Examiner has found, and the Appellants have not disputed, that:

Yaniger (4,822,638) teaches production of conductive polymers of polyaniline for electronic circuits. Yaniger (4,822,638) applies a polymer to a substrate and chemically doping the polymer to produce two distinct regions of the polymer having different conductivity. A variety of designs can be made using the invention. The dopant can be applied a variety of ways including spraying, immersion and brushing. The conductivity

of the treated areas can also vary in conductivity (col. 6, line 50 - col. 7, line 65). The conductivity type is not changed. Yaniger (4,822,638) teaches selective diffusion of the doping material into the bulk body (col. 7, lines 35-40). Yaniger (4,822,638) teaches electronic devices such as resistors, capacitors, inductors and printed circuit boards can be produced from the invention (col. 2, lines 60-68).

(*Compare* Ans. 3 with Br. 12-18). Nor have the Appellants disputed the Examiner's determination that one of ordinary skill in the art would have been led to drive the dopant into the polymeric film via the post heat treating step taught by Barry, Jr. with a reasonable expectation of successfully increasing the conductivity of the doped polyaniline.² (*Compare* Ans. 4, with Br. 12-18). Rather, the Appellants contend that the prior art references do not teach or suggest using the "pattern mechanism" recited in claims 1 and 47 to provide the conductive patterns taught by Yaniger (Br. 12-18).

The dispositive question is, therefore, whether one of ordinary skill in the art would have been led to employ the "pattern mechanism" recited in claims 1 and 47 to provide the conductive patterns taught by Yaniger within the meaning of 35 U.S.C. § 103(a)? On this record, we answer this question in the affirmative.

As recognized by the Examiner (Ans. 7), Yaniger discloses forming a conductive pattern by patterning means other than those claimed, e.g., patterned rollers and/or ink jet patterning. We find that Yaniger, for

² We also note that Yaniger's teaching drawn to selective diffusion of treating or doping materials into the bulk body of the base insulating polymer constitutes the claimed "driving said at least one conductivity-altering species into said regions of said film..." recited in claims 1 and 47. (*See also* Yaniger, col. 7, ll. 21-40).

example, teaches the masking-spraying procedure (similar to Lawrence's screen printing) illustrated in Figure 1b or the *painting* procedure illustrated in Figure 6 to apply a liquid covalent doping agent on, e.g., polyaniline to provide a plastic *printed* circuit board (without using a metal conductor such as copper) (Yaniger, col. 8, ll. 14-35, and Lawrence 1, para. 0002).

Although Yaniger does not mention using the claimed specific "patterning mechanism," the Examiner has correctly found that Lawrence teaches that printing means, such as gravure or flexographic printing, can also be used to apply a pattern of conductive ink containing even metal particulate materials and/or carbon black on plastic films to form resistors, capacitors, inductors and printed circuit boards (Ans. 4 and Lawrence 4, para.0035 to para. 0042 and Lawrence 5, para. 0045 to 0047). The Examiner has found (Ans. 4) that:

Lawrence et al. (2003/0151028) teaches flexographic printing using a printing plate where the ink is applied by immersion in a trough or by ink being metered onto the roller by an enclosed chamber unit, i.e. inkjet device ([0036]).

This finding is not inconsistent with the ink jet printing broadly described at page 4 of the Appellants' own Specification. We find that Lawrence also teaches gravure printing using an engraved gravure cylinder and/or an impression roller which correspond to the claimed patterned roller or which may be made by molding (pattern mold). (*Compare* Lawrence 4, para. 0037, with the Appellants' claim 1). In any event, the Appellants acknowledge at page 4 of the Specification that "xerographic procedures...[such as] laser printing, ink jet printing (e.g., solid jet, bubble jet, piezo jet, etc.)..." are known printing processes. *In re Nomiya*, 509 F.2d 566, 570-71 (CCPA 1975)(the admitted prior art in an applicant's

Specification may be used in determining the patentability of a claimed invention); *see also In re Davis*, 305 F.2d 501, 503 (CCPA 1962).

Given the readily recognized and expected advantages of known patterning devices, such as ink jet printing and gravure printing, over the paint brush taught by Yaniger, we concur with the Examiner that one of ordinary skill in the art would have been led to employ the claimed known patterning devices, in lieu of, for example, the paint brush, in Yaniger's method of fabricating electronic devices with a reasonable expectation of successfully and efficiently applying Yaniger's treating or dopant solution on a plastic substrate in the form of a desired conductive pattern. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. at 1740 (“[W]hen a patent ‘simply arranges old elements with each performing the same function it had been known to perform’ and yields no more than one would expect from such an arrangement, the combination is obvious.”).

In reaching this conclusion, we note the Appellants' argument that one of ordinary skill in the art would not have had a reasonable expectation of successfully applying the treating or doping agents taught by Yaniger on polyaniline films via the claimed patterning mechanism, such as ink jet printing. However, the Examiner has correctly indicated at page 7 of the Answer that the Appellants' argument cannot take the place of objective evidence. *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984). This is especially true in this situation since known printing processes, such as ink jet printing and gravure printing, are also known to produce patterns using various inks or coating compositions containing no metal particulates.

Thus, based on the factual findings set forth in the Answer and above, we determine that the preponderance of evidence weighs most heavily in favor of obviousness of the subject matter defined by claims 1, 2 and 47 within the meaning of 35 U.S.C. § 103(a).

CLAIMS 3 THROUGH 22:

As evidence of obviousness of the subject matter defined by claims 3 through 22 under 35 U.S.C. § 103(a), the Examiner has relied on the combined disclosures of Yaniger, Lawrence, Barry, Jr., and Angelopoulos. The relevant disclosures of Yaniger, Lawrence and Barry, Jr. are discussed above. The Examiner has acknowledged that Yaniger, Lawrence and Barry, Jr. are silent as to the claimed solvent utilized in a conductive polymer solution for forming films (Ans. 5). To remedy this deficiency, the Examiner has stated (*id*) that:

Angelopoulos et al. (5,300,208) teaches conductive polymers with the claimed solvents which are doped to changed the conductivity thereof (col. 2, lines 18-40 and Example III).

Therefore, it would have been obvious for one skilled in the art at the time the invention was made to... [form] the conductive polymer with the claimed solvent with the expectation of achieving similar results.

The Appellants have not challenged the Examiner's position above (Br. 18-19). Rather, the Appellants appear to rely on the same arguments discussed in the context of the Examiner's rejection of claims 1, 2, and 47 (*id*).

Thus, for the reasons set forth above and in the Answer, we determine that the preponderance of evidence weighs most heavily in favor of

obviousness of the subject matter defined by claims 3 through 22 within the meaning of 35 U.S.C. § 103(a).

CLAIMS 23 THROUGH 31, 34 through 37, 39 through 44, 46, and 47:

As evidence of obviousness of the subject matter defined by claims 23 through 31, 34 through 37, 39 through 44, 46, and 47 under 35 U.S.C. § 103, the Examiner has relied on the combined disclosures of Yaniger, Lawrence, Barry, Jr., Angelopoulos and Schoch. Consistent with the Examiner's finding *supra*, we note that Yaniger teaches forming conductive patterns (doped area) on non-conductive (non-doped areas) polyaniline films to produce electronic devices (*see also* Yaniger, col. 6, l. 58 to col. 8, l. 35). These conductive patterns are formed by applying treating or doping agents via, e.g., Lawrence's engraved gravure cylinder and an impression roller (which correspond to the claimed patterned rollers recited in claim 34 and/or which could have been made by molding (pattern mold recited in claim 44)) or the known ink jet printing discussed *supra* (the ink jet printing recited in claim 35) on non-conductive polyaniline films to define desired conductive patterns (desired doped areas) as indicated above. As argued by the Appellants (Br. 19-21 and Reply Br. 6-7), Yaniger does not mention de-doping portions of the already doped polymeric film as required by claim 23.

The dispositive question is, therefore, whether one of ordinary skill in the art would have been led to de-doping of portions of the already doped polymeric film as required by claim 23 to form Yaniger's non-conductive (non-doped area) polymeric film having a doped area defining a conductive pattern within the meaning of 35 U.S.C. § 103(a)? On this record, we answer this question in the affirmative.

As is readily apparent from column 7, lines 13-20, of Yaniger, its non-conductive polymeric film can be treated with a doping agent to form an entirely doped polymeric film. Although Yaniger does not mention de-doping selected portions of this entirely doped polymeric film to define a desired doped area (desired conductive pattern), it is well within the ambit of one of ordinary skill in the art to recognize that such de-doping is equivalent to and interchangeable with doping selected portions of a non-doped polymeric film to define a desired doped area (desired conductive pattern). *See Corning Glass Works v. Sumitomo Electric*, 868 F.2d 1251, 1259-1261 (Fed. Cir. 1999) (holding that the addition of a negative dopant in the cladding (outer layer) is equivalent to and interchangeable with adding a positive dopant in the core for the purpose of producing the same outcome, i.e., a fiber optic core having a higher refractive index than that of the cladding). This is especially so since the use of a neutralizing agent to neutralize dopants (de-doping) was known at the time of the invention. In this regard, we note that the Appellants have not specifically challenged the Examiner's official notice at page 6 of the Answer that "the use of neutralizing agents to neutralize the dopants...[was] known in the art."³ *In re Soli*, 317 F.2d 941, 945-46 (CCPA 1963).

Accordingly, based on the factual findings set forth in the Answer and above, we determine that the preponderance of evidence weighs most heavily in favor of obviousness of the subject matter defined by claims 23

³ The Appellants have not specifically pointed out why the noticed fact is not considered to be common knowledge or well-known in the art. *See also* 37 C.F.R. § 1.111(b).

through 31, 34 through 37, 39, 40, 44, 46, and 47 within the meaning of 35 U.S.C. § 103(a).

However, the Examiner's § 103 rejection of claims 41 through 43 is on a different footing. Although the Appellants separately argue the limitations of claims 41 through 43, the Examiner has not identified any factual findings relevant to the subject matter defined by claims 41 through 43. (*Compare Br. 22-23 with Ans. 1-9*). Nor has the Examiner explained why one of ordinary skill in the art would have been led to arrive at the subject matter recited in claims 41 through 43.

Accordingly, we are constrained to agree with the Appellants that the Examiner has not established a prima facie case of obviousness regarding the subject matter defined by claims 41 through 43 within the meaning of 35 U.S.C. § 103(a).

CONCLUSION

In view of the foregoing:

1. The Examiner's § 103 rejection of claims 1, 2, and 47 as unpatentable over Yaniger, Lawrence, and Barry, Jr. is affirmed;
2. The Examiner's § 103 rejection of claims 3 through 22 as unpatentable over Yaniger, Lawrence, Barry, Jr., and Angelopoulos is affirmed;
3. The Examiner's § 103 rejection of claims 23 through 31, 34 through 37, 39, 40, 44, 46, and 47 as unpatentable over Yaniger, Lawrence, Barry, Jr., Angelopoulos, and Schoch is affirmed ; and

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4. The Examiner's § 103 rejection of claims 41 through 43 as unpatentable over Yaniger, Lawrence, Barry, Jr., Angelopoulos, and Schoch is reversed.

ORDER

In view of the forgoing, the decision of the Examiner is affirmed-in-part.

TIME PERIOD

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

AFFIRMED-IN-PART

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