UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ANALOG DEVICES, INC.
Requester

v.

KNOWLES ELECTRONICS LLC
Patent Owner and Appellant

Appeal 2015-004989
Reexamination Control 95/001,850
Technology Center 3900
Patent 8,018,049 B2

Before JOHN A. JEFFERY, MARC S. HOFF, and ERIC B. CHEN, *Administrative Patent Judges*.

CHEN, *Administrative Patent Judge*.

DECISION ON APPEAL

Patent Owner, Knowles Electronics LLC, appeals under 35 U.S.C. § 134(b) and 35 U.S.C. § 315(a) (pre-AIA) the Examiner's final decision to reject claims 1, 2, 5, 6, 9, 11, 12, 15, 16, 19, 21–23, 25 and 26. Claims 3, 4, 7, 8, 10, 13, 14, 17, 18, 20, and 24 are not subject to reexamination.

Third-Party Requester Analog Devices, Inc. did not file any Respondent Briefs.

An oral hearing was held on August 5, 2015. The record will include a written transcript of the oral hearing in due course.

We have jurisdiction under 35 U.S.C. §§ 134 and 315 (pre-AIA). We affirm.

STATEMENT OF THE CASE

A request for *inter partes* reexamination of U.S. Patent No. 8,018,049 B2 (the '049 patent) was filed on December 23, 2011, by Third-Party Requester Analog Devices, Inc., and assigned Reexamination Control No. 95/001,850.

The '049 patent, entitled "Silicon Condenser Microphone and Manufacturing Method," issued September 13, 2011 to Anthony D. Minervini, based on Application No. 11/741,881, filed April 30, 2007.

The '049 patent is a divisional of Application No. 10/921,747 filed August 19, 2004, now U.S. Patent No. 7,434,305, which is a continuation-in-part of Application No. 09/886,854, filed June 21, 2001, now U.S. Patent No. 7,166,910.

The '049 patent is assigned to Knowles Electronics LLC, the real party in interest.

Related Litigation

The '049 patent has been asserted in *Knowles Electronics, LLC v. Analog Devices, Inc.*, No. 1:11-cv-6804 (N.D. Ill. Sept. 27, 2011) and *In the Matter of Certain Silicon Microphone Packages and Products Containing the Same*, No. 337-TA-825 (USITC Dec. 7, 2011). These cases have been terminated. (PO App. Br. 1.)

The '049 patent has also been asserted in *Knowles Electronics, LLC v. GoerTek, Inc.*, No. 1:13-cv-4586 (N.D. Ill. Jun. 21, 2013) and *In the Matter of Certain Silicon Microphone Packages and Products Containing Same*, No. 337-TA-888 (USITC Jun. 21, 2013). (*Id.*) These cases have also been terminated.

The Claims

Claims 1, 21, and 22 are exemplary, with disputed limitations in italics:

> 1. A silicon condenser microphone *package* comprising:
>
> a package housing formed by connecting a multi-layer substrate comprising at least one layer of conductive material and at least one layer of nonconductive material, to a cover comprising at least one layer of conductive material;
>
> a cavity formed within the interior of the package housing;
>
> an acoustic port formed in the package housing; and
>
> a silicon condenser microphone die disposed within the cavity in communication with the acoustic port;
>
> where the at least one layer of conductive material in the substrate is electrically connected to the at least one layer of

conductive material in the cover to form a shield to protect the silicon condenser microphone die against electromagnetic interference.

21. A method of manufacturing a silicon condenser microphone package comprising:

providing a panel comprising a plurality of interconnected package substrates, where each of the plurality of package substrates comprises at least one layer of conductive material and at least one layer of non-conductive material;

attaching a plurality of silicon condenser microphone dice to the plurality of package substrates, one die to each package substrate;

attaching a plurality of package covers, each comprising at least one layer of conductive material, to the panel, one package cover to each of the package substrates, where attaching the plurality of package covers to the panel comprises electrically connecting the at least one layer of conductive material in the package cover to the at least one layer of conductive material in the corresponding package substrate to form a shield to protect the silicon condenser microphone die against electromagnetic interference; and

separating the panel into a plurality of individual silicon condenser microphone packages.

22. The method of claim 21, *where each of the plurality of package substrates further comprises an acoustic port*.

The Rejections

Patent Owner appeals the Examiner's decision to reject all the pending claims as follows:

1. Claims 1, 2, 5, 6, 9, 11, 12, 15, 16, and 19 stand rejected under 35 U.S.C. § 102(e) as anticipated by Halteren (US 6,324,907 B1; Dec. 4, 2001).

2. Claims 1, 9, 11, 12, 15, 16, and 19 stand rejected under 35 U.S.C. § 102(b) as anticipated by Baumhauer (US 4,533,795; Aug. 6, 1985).

3. Claims 1, 2, 5, 6, 11, 12, 15, 16, and 19 are rejected under 35 U.S.C. § 103(a) as obvious over Une (US 6,594,369 B1; July 15, 2003) and Halteren.

4. Claims 1, 2, 5, 6, 11, 12, 15, 16, and 19 are rejected under 35 U.S.C. § 103(a) as obvious over Une and Baumhauer.

5. Claims 1, 2, 5, 6, 11, 12, 15, 16, and 19 are rejected under 35 U.S.C. § 103(a) as obvious over Une and Mullenborn (US 6,522,762 B1; Feb. 18, 2003).

6. Claims 1, 11, 12, 15, 16, and 19 stand rejected under 35 U.S.C. § 103(a) as obvious over Sjursen (US 7,003,127 B1; Feb. 21, 2006) and Halteren.

7. Claims 1, 11, 12, 15, 16, and 19 are rejected under 35 U.S.C. § 103(a) as obvious over Sjursen and Baumhauer.

8. Claims 1, 11, 12, 15, 16, and 19 are rejected under 35 U.S.C. § 103(a) as obvious over Sjursen and Mullenborn.

9. Claims 21–23, 25, and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Une and Halteren.

10. Claims 21–23, 25, and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Une and Baumhauer.

11. Claims 21, 25, and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Une and Mullenborn.

12. Claims 22 and 23 stand rejected under 35 U.S.C. § 103(a) as obvious over Une, Mullenborn, and Halteren.

13. Claims 21–23, 25, and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Glenn '705 (US 6, 177,705; Sept. 12, 2000) and Halteren.

14. Claims 21–23 and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Glenn '705 and Baumhauer.

15. Claims 21–23, 25, and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Glenn '653 (US 6,526,653 B1; Mar. 4, 2003) and Halteren.

16. Claims 21–23 and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Glenn '653 and Baumhauer.

17. Claims 21–23 and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Carpenter (US 6,928,718 B2; Aug. 16, 2005) and Halteren.

18. Claims 21–23 and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Carpenter and Baumhauer.

Patent Owner relied upon the following declaration in rebuttal to the Examiner's proposed rejection:

> Declaration under 37 C.F.R. § 1.132 of Peter V. Loeppert, Ph.D., dated May 7, 2012 ("Loeppert Declaration" or "Loeppert Decl.").

ANALYSIS

Claim Interpretation

In view of both intrinsic and extrinsic evidence, Patent Owner advocates the following claim construction:

> [O]ne of ordinary skill in the art, at the time of the Minervini invention, would understand that a "package" is, at a minimum, an enclosure for a device or circuit that provides (a) protection from mechanical and environmental stress, (b) a first-level interconnect between the enclosed device/circuit and the package, and (c) *a second level interconnect between the package and an external printed circuit board.*

(PO App. Br. 8 (emphasis added).)

To support this claim construction, Patent Owner has submitted several technical references as evidence providing a definition for "package" in the context of microelectronics, as interpreted by one of ordinary skill in the art. (PO App. Br. 6–8.) In particular, one relevant definition of "package" which refers to a "second level interconnect" is as follows:

> We can think of the package as a structure consisting of a semiconductor device, a first-level interconnect system, a wiring structure, *a second-level interconnection platform*, and an enclosure that protects the system and provides the mechanical platform for the sublevel.

(PO App. Br. 7 (quoting Ken Gilleo, ELECTRONIC PACKAGE & INTERCONNECTION HANDBOOK 1.22 (Charles A. Harper ed., McGraw-Hill 3rd ed. 2000)) (emphasis added).)

Although this definition generally refers to "a second-level interconnection platform," such definition does not expressly require the second-level interconnect to be connected to a printed circuit board. Accordingly, Patent Owner further argues that:

> the second-level connection – the broadest reasonable interpretation of a package, as viewed by one of ordinary skill in the art, is that the second-level connection must be made <u>one of two ways</u>, either (a) by inserting the package pins into the plated through-holes of a printed circuit board and then soldering them into place or (b) by placing specially-configured

> pins or pads onto corresponding "lands" on the top surface of the printed circuit board and then soldering them in place.

(PO App. Br. 9–10.) To support this argument, Patent Owner provides a citation to another technical reference, which states that "*[i]n general*, IC packages can be classified into two categories: 1) through-hole, and 2) surface mount." (PO App. Br. 10 (quoting FUNDAMENTALS OF MICROSYSTEMS PACKAGING 67 (Rao R. Tummala ed., McGraw-Hill 2001) (emphasis added).) Because the phrase "in general" modifies that remainder of the sentence describing IC packages, Tummala does not support Patent Owner's argument requiring all second-level connections to be either a through-hole mount or a surface mount. Instead, the phrase "in general" means that in most instances, the second-level connections can either be a through-hole mount or a surface mount, but permits for possible exceptions.

Moreover, the '049 patent provides several references to a printed circuit board including the following:

> Referring to FIG. 15, an embodiment of the bottom portion 50 is illustrated. The bottom portion 50 of this embodiment includes a solder mask layer 68 and alternating layers of conductive and non-conductive material 44, 46. *The bottom portion further comprises solder pads 70 for electrical connection to an end user's board.*

(Col. 6, ll. 37–42 (emphasis added).) In another embodiment, microphone package 40 (col. 7, ll. 5–6) is disclosed as follows:

> In FIG. 26, *connection to the end user's board is made through the top portion 48 or the bottom portion 53*. The package mounting orientation is either top portion 48 down or bottom portion 50 down. Connection from the transducer 58 to

> the plated through holes is made by flip chipping or wire bonding and trace routing.

(Col. 7, ll. 38–43 (emphasis added).) However, neither embodiment provides express language to support Patent Owner's interpretation of "package" that requires "a second level interconnect between the package and an external printed circuit board." Thus, the importation of a narrow embodiment into the broader independent claim 1 is improper. *See SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) ("For example, a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.")

Thus, the claim construction advocated by Patent Owner is unpersuasive because such an interpretation of "package" that requires "a second level interconnect between the package and an external printed circuit board" is overly narrow and unsupported by both intrinsic and extrinsic evidence.

§ 102 Rejection—Halteren

The Examiner found that the flexible substrate transducer assembly of Halteren corresponds to the limitation "package," as recited in independent claim 1. (RAN 6.) We agree with the Examiner's determination.

Halteren relates to a flexible substrate transducer assembly, in particular, an electro-acoustic transducer. (Col. 1, ll. 5–7.) Figure 2A of Halteren illustrates flexible substrate transducer assembly 10, including silicon microphone 61 and Application Specific Integrated Circuit (ASIC) 62 mounted on flexible member 40 (col. 7, ll. 52–57) and "[metal] lid 70

[that] covers the transducer system and shields it from the external environment" (col. 8, ll. 11–13). Halteren explains that "the lid function[s] as an EMI shield that effectively shields the transducer system and the generated transducer signals from interfering electromagnetic signals of the external environment." (Col. 3, ll. 50–53.) Figure 2A, a cross-sectional view of transducer assembly 10, is reproduced below:

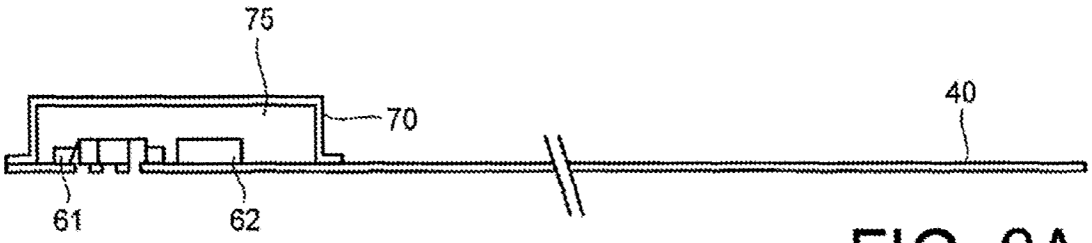


FIG. 2A

Halteren explains that ASIC 62 receives output signals from silicon microphone 62 (col. 7, ll. 54–55) and that flexible member 40 includes four electrical conductors 20–23 to provide electrical connections to a piece of electronic equipment (col. 7, ll. 30–36). Because Halteren explains that transducer assembly 10 includes the features of: (i) ASIC 62 receiving output signals from silicon microphone 61; (ii) metal lid 70 shielding transducer assembly 10 from the external environment, including interfering electromagnetic signals; and (iii) flexible member 40 connecting transducer assembly 10 to electronic equipment, Halteren discloses the limitation "package," as recited in claim 1.

Patent Owner argues that:

> Inasmuch as the original examiner was provided not only with the prior art references themselves, but also with the analysis of the prior art references by the ITC [International Trade

> Commission] and the arguments raised by the Requester in the ITC proceeding, the original examiner's allowances over these references are reliable and should not be disturbed.

(PO App. Br. 16.) To the extent Patent Owner is arguing that the Examiner's determination with respect to a substantial new question of patentability based on Halteren was improper, Patent Owner can seek review by filing a petition to the Director, rather than appeal. *See Belkin Int'l, Inc. v. Kappos*, 696 F.3d 1379, 1382–83 (Fed. Cir. 2012).

Patent Owner further argues that "using the proper meaning of 'package,' one of ordinary skill would not view [Halteren] as a 'package' because it lacks a package's second-level connection" and "a package is mechanically and electrically connected to a printed circuit board by either through-hole or surface mounting." (PO App. Br. 17.) However, as discussed previously, Patent Owner's interpretation of "package," which requires "a second level interconnect between the package and an external printed circuit board" is overly narrow and unsupported by both intrinsic and extrinsic evidence.

Accordingly, we affirm the Examiner's decision to reject claims 1, 2, 5, 6, 9, 11, 12, 15, 16, and 19 under 35 U.S.C. § 102(e) as anticipated by Halteren.

§ 103—Une and Halteren

Claims 21, 25, and 26

The Examiner acknowledged that Une does not disclose the limitation "attaching a plurality of silicon condenser microphone dice to the plurality of package substrates," as recited in independent claim 21 and, therefore,

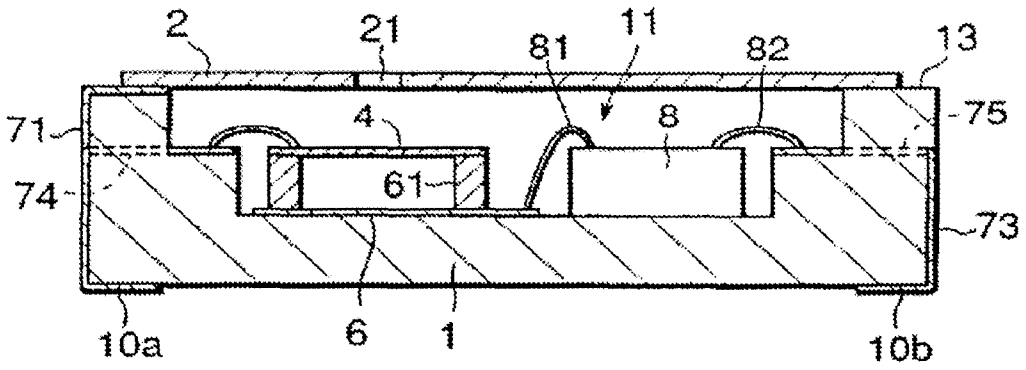
relied on Halteren for teaching a silicon microphone. (RAN 34–35.) The Examiner concluded that "[i]t would have been obvious . . . to use the silicon condenser microphone of Halteren in Une's invention because the substitution of one known element for another would have yield predictable results." (RAN 35.) We agree with the Examiner's determination.

Une relates to "an electret capacitor microphone." (Col. 1, ll. 7–8.) Une explains that such electret capacitor microphones are characterized by

> a thin diaphragm having a thin metal film facing toward an opening in a metal casing and a fixed electrode opposed thereto, and utilize the principal of a change in capacity between the diaphragm and the fixed electrode dependently on the vibration of the diaphragm due to a sound wave.

(Col. 1, ll. 10–15.) Figure 8 of Une illustrates an embodiment in which a capacitor portion (i.e., electret capacitor microphone), including diaphragm 4 and fixed electrode 6, and solid state device 8 are arranged in parallel (col. 9, ll. 50–53), such that solid state device 8 converts changes in capacity caused by a sound wave vibration into a voltage or current (col. 5, ll. 5–10). Figure 8 of Une, a cross-section view of the capacitor portion arranged in parallel with solid state device 8, is reproduced below:

Fig. 8



Combining Une and Halteren is no more than the simple substitution of the known silicon microphone 61 of Halteren for the known electret capacitor microphone of Une, to yield predictable results. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007). Moreover, because silicon microphone 61 of Halteren sends output signals to ASIC 62 and solid state device 8 of Une converts capacitance measured from electret capacitor microphone, both Halteren and Une apply similar modes of operation by converting measured vibration into electrical signals. Thus, we agree with the Examiner (RAN 35) that modifying Une to incorporate silicon microphone 61 of Halteren would have been obvious.

Patent Owner argues that:

> The Examiner offered no evidence to suggest that discrete microphone components are swappable for MEMS components, no explanation of how one of ordinary skill might go about engineering the proposed substitution, no explanation of what modifications to the die or case would be necessary to make the proposed substitution, and no evidence that the Une '369 casing is compatible in terms of size and materials to accommodate the MEMS die of [Halteren].

(PO App. Br. 34.) However, Patent Owner's argument is unpersuasive because it is based upon bodily incorporating silicon microphone 61 of Halteren, rather than the combined teachings of Halteren and Une. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981) ("The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference . . . . Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.").

Patent Owner further argues that "Fig. 8 is [of Une] inoperable, and so one of ordinary skill in the art would be unlikely to use Fig. 8 as a starting point . . . in designing the silicon condenser microphone package . . . and would certainly have no reasonable expectation that the resulting device would function." (PO App. Br. 35; *see also id.* at 26.) To support this position, Patent Owner points to paragraphs 5–6 of the Loeppert Declaration. (*Id.*) A relevant portion of the Loeppert Declaration states:

> I have reviewed Une '369, and in particular, Figs. 6A and 8. In each of these figures, the capacitor is formed by elements 4 (the diaphragm) and 6 (the fixed electrode). In both figures, the fixed electrode [6] is flush against the bottom of the casing [1], leaving only the room between them for a back volume. Since the spacing must be very small to produce a usable capacitance value, it is unlikely that the disclosed non-MEMS microphone would function properly in this configuration, and if a MEMS condenser microphone transducer was used in this configuration, given its typically even smaller gap between the diaphragm and fixed electrode, it would almost certainly fail to function properly.

(Loeppert Decl. ¶ 6.) However, because Une is silent with respect to the scale of Figure 8, arguments based on measurement of the drawing features are of little value. *See Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue."). Furthermore, the statements in the Loeppert Declaration relied upon by Patent Owner lack persuasive factual support because the Loeppert Declaration does not cite to sufficient corroborating evidence. *See In re*

Beattie, 974 F.2d 1309, 1313 (Fed. Cir. 1992) ("[D]eclarations themselves offer only opinion evidence which has little value without factual support.").

Accordingly, we affirm the Examiner's decision to reject claims 21, 25, and 26 under 35 U.S.C. § 103(a) as obvious over Une and Halteren.

Claims 22 and 23

The Examiner found that the holes extending through the flexible member of Halteren corresponds to the limitation "where each of the plurality of package substrates further comprises an acoustic port," as recited in dependent claim 22. (RAN 35–36.) We agree with the Examiner's determination.

Halteren explains that "the supporting area of the flexible elongate member [40] comprises one or several holes extending through the flexible elongate member so as to provide a first passage to the external environment between the lower surface of the member and the transducer system covered by the lid." (Col. 2, ll. 52-56.) Halteren further explains that "silicon microphone 61 is arranged with front side of its membrane facing the holes and its backside facing a cavity 75 formed by the lid 70 and the flexible member 40." (Col. 8, ll. 13–15.) Because Halteren explains that holes are formed in flexible elongate member 40, Halteren teaches the limitation "where each of the plurality of package substrates further comprises an acoustic port."

Figure 2A of Halteren illustrates a microphone configuration in which holes (i.e., the claimed "acoustic port") are formed in flexible elongate member 40 (i.e. the claimed "package substrate"), rather than metal lid 70.

Accordingly, combining Une and Halteren is no more than the simple substitution of one known microphone configuration (i.e., holes are formed in flexible elongate member 40 of Halteren) for another known configuration (i.e., sound hole 21 in metal cover 2 of Une), to yield predictable results. *See KSR*, 550 U.S. at 417.

Patent Owner argues that "the Examiner offered no rationale for combining Une '369 with the acoustic port of [Halteren]" and "the Examiner assumes but does not support the conclusions that (a) an appropriate port can be made in the ceramic substrate of Une '369 . . . and (b) the port in the substrate wouldn't interfere with the position of the sound hole 21 in the cover 2." (PO App. Br. 35.) However, as discussed previously, the combination of Une and Halteren is based on the simple substitution of one known microphone configuration for another known microphone configuration.

Accordingly, we affirm the Examiner's decision to reject claims 22 and 23 under 35 U.S.C. § 103(a) as obvious over Une and Halteren.

Other §§ 102 and 103 Rejections

We do not reach the rejections of: (i) claims 1, 9, 11, 12, 15, 16, and 19 under 35 U.S.C. § 102(b) as anticipated by Baumhauer; (ii) claims 1, 2, 5, 6, 11, 12, 15, 16 and 19 under 35 U.S.C. § 103(a) as obvious over various combinations of Une, Baumhauer, Mullenborn, Sjursen, and Halteren; and (iii) claims 21–23, 25 and 26 under 35 U.S.C. § 103(a) as obvious over various combinations of Une, Baumhauer, Mullenborn, Halteren,

Glenn '705, Glenn '653, and Carpenter.[1] Affirmance of the rejections discussed previously renders it unnecessary to reach the remaining rejections, as all of pending claims have been addressed and found unpatentable. *Cf. In re Gleave*, 560 F.3d 1331, 1338 (Fed. Cir. 2009) (not reaching additional obviousness rejections).

DECISION

The Examiner's decision to reject claims 1, 2, 5, 6, 9, 11, 12, 15, 16, and 19 under 35 U.S.C. § 102(e) as anticipated by Halteren is sustained.

The Examiner's decision to reject of claims 21–23, 25 and 26 under 35 U.S.C. § 103(a) as obvious over Une and Halteren is sustained.

Requests for extensions of time in this *inter partes* reexamination proceeding are governed by 37 C.F.R. § 1.956. *See* 37 C.F.R. § 41.79.

In the event neither party files a request for rehearing within the time provided in 37 C.F.R. § 41.79, and this decision becomes final and appealable under 37 C.F.R. § 41.81, a party seeking judicial review must timely serve notice on the Director of the United States Patent and Trademark Office. *See* 37 C.F.R. §§ 90.1 and 1.983.

AFFIRMED

---

[1] Patent Owner's supplemental citation to *Power Integrations, Inc. v. Lee*, No. 2014-1123, 2015 WL 4757642 (Fed. Cir. Aug. 12, 2015), filed August 18, 2015, has been considered. However, Patent Owner's argument with respect to Baumhauer has been rendered moot, because we do not reach the additional rejections of claims under 35 U.S.C. §§ 102 and 103 as either anticipated by or obvious over Baumhauer, alone or in combination with various references.

Appeal 2015-004989
Reexamination Control 95/001,850
Patent 8,018,049 B2

peb

PATENT OWNER:

LATHROP & GAGE LLP
2345 Grand Boulevard
Suite 2400
Kansas City, MO 64108

THIRD PARTY REQUESTER:

SUNSTEIN KANN MURPHY & TIMBERS LLP
125 Summer Street
Boston, MA 02110-1618