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Paper No. 7
Entered: January 23, 2020

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ABBOTT LABORATORIES, ABBOTT LABORATORIES, INC.,
ST. JUDE MEDICAL, INC., and CARDIOMEMS LLC,
Petitioner

v.

INTEGRATED SENSING SYSTEMS, INC.,
Patent Owner.

IPR2019-01339
Patent 6,926,670 B2

Before SCOTT A. DANIELS, ROBERT A. POLLOCK, and
ALYSSA A. FINAMORE, *Administrative Patent Judges.*

FINAMORE, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Petitioner filed a Petition (Paper 2, "Pet.") requesting an *inter partes* review of claims 1–5, 21–29, and 31 of U.S. patent number 6,926,670 B2, hereinafter "the '670 patent." Pet. 1. Patent Owner did not file a preliminary response.

We have authority, acting under the designation of the Director, to determine whether to institute an *inter partes* review. 35 U.S.C. § 314; 37 C.F.R. § 42.4(a). We may not authorize an *inter partes* review to be instituted "unless . . . the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a).

Upon consideration of the arguments and evidence presented by the Petitioner, we determine Petitioner has demonstrated a reasonable likelihood that Petitioner would prevail with respect to at least one of the claims challenged in the Petition. Accordingly, we hereby institute an *inter partes* review of the challenged claims of the '670 patent.

II. BACKGROUND

A. Real Parties in Interest

Petitioner identifies Abbott Laboratories, Abbott Laboratories, Inc., St. Jude Medical, LLC, and CardioMEMS LLC as the real parties in interest. Pet. 1. Patent Owner identifies its real party in interest as Integrated Sensing Systems, Inc. Paper 6, 1.

B. Related Matters

The parties identify the following district court proceeding: *Integrated Sensing Systems, Inc. v. Abbott Laboratories*, No. 2:19-cv-10041 (E.D.

Mich. filed Jan. 4, 2019). Pet. 2; Paper 6, 1. Patent Owner also identifies the following proceeding before the Board: *Abbott Laboratories v. Integrated Sensing Systems, Inc.*, IPR2019-01338 (PTAB filed July 15, 2019).

C. The ’670 patent (Ex. 1001)

The ’670 patent has a January 22, 2002, filing date. Ex. 1001, code 22. Also, the ’670 patent claims priority to two U.S. provisional applications, namely provisional application number 60/263,327 (Ex. 1003), filed January 22, 2001, and provisional application number 60/278,634 (Ex. 1004), filed March 26, 2001. *Id.* at code 60.

The ’670 patent “relates to the field of MEMS (micro-electromechanical systems) sensors and more specifically to a wireless MEMS capacitive sensor for implantation into the body of a patient to measure one or more physiologic parameters.” *Id.* at 1:15–20. According to the ’670 patent, wireless sensors rely on magnetic coupling between an inductor coil associated with an implanted device and a separate, external “readout” coil. *Id.* at 1:33–36. One well-known method of wireless communication is that of the LC (inductor-capacitor) tank resonator. *Id.* at 1:36–38. In an LC tank resonator, a series-parallel connection of a capacitor and inductor has a specific resonant frequency, expressed as $1/\sqrt{LC}$, which can be detected from the impedance of the circuit. *Id.* at 1:38–42. If one element of the inductor-capacitor pair varies with some physical parameter, e.g., pressure, the physical parameter may be determined by the resonant frequency. *Id.* at 1:42–45.

Figure 1, reproduced below, shows a wireless MEMS sensor system described in the ’670 patent.

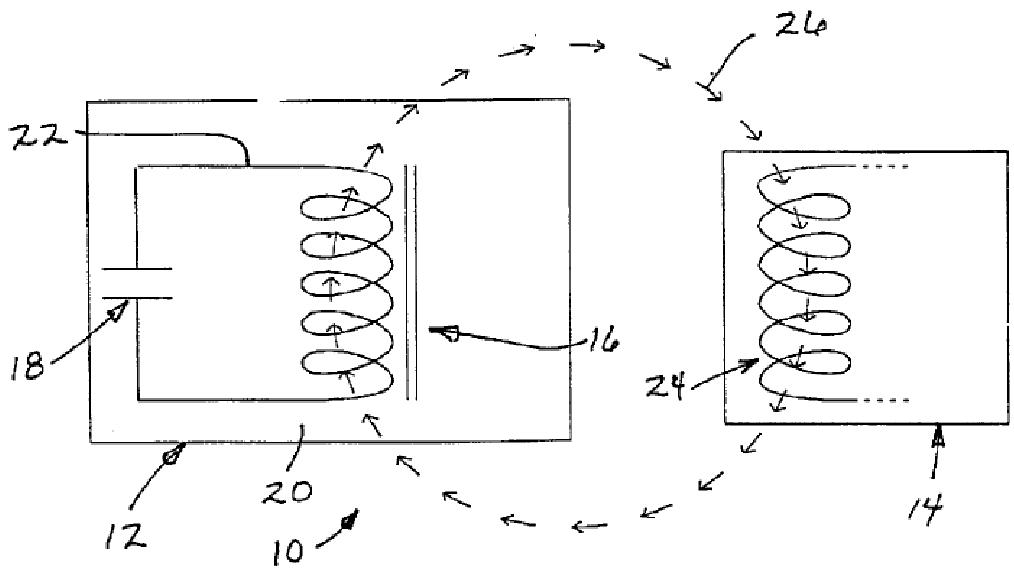

Figure 1

Figure 1 is a schematic illustration of a wireless MEMS sensor system. *Id.* at 4:32–34. System 10 includes microfabricated implantable sensing device 12 for coupling with external readout device 14. *Id.* at 5:54–56. Sensing device 12 includes capacitive pressure sensor 18 integrated into common substrate 20 with integrated inductor 16. *Id.* at 5:60–62. Readout device 14 includes second inductor 24, which couples magnetically 26 with integrated inductor 16 of sensing device 12. *Id.* at 5:62–64.

Figure 3 shows in detail the components sensing device 12, and we reproduce Figure 3 below.

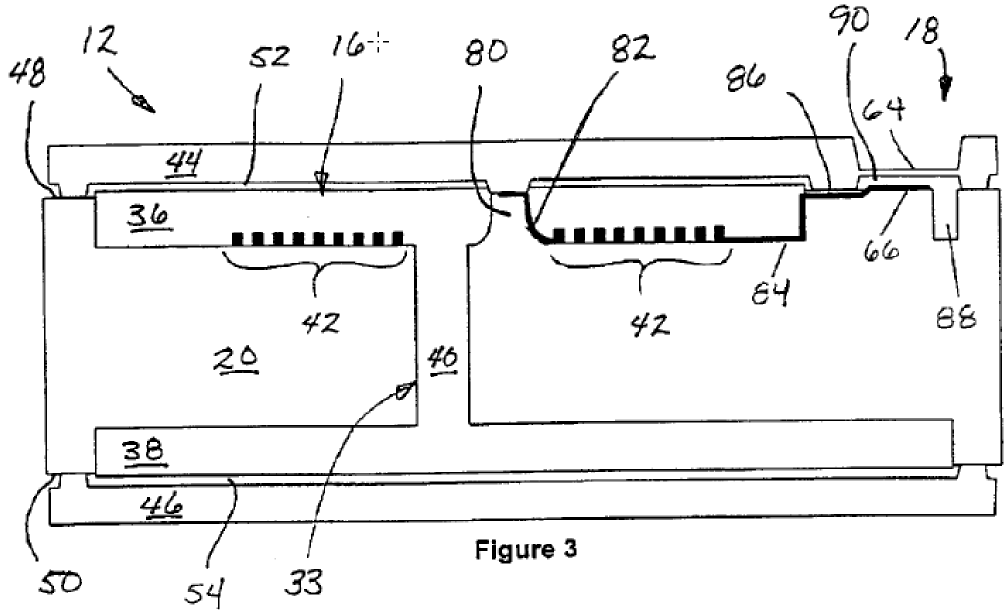

Figure 3

Figure 3 is a cross-sectional representation of sensing device 12. *Id.* at 4:38–39. Sensing device 12 includes common substrate 20 and main substrate 34. *Id.* at 5:60–62, 6:17–20. Formed and located within recessed regions of substrate 34 is integrated inductor 16. *Id.* Integrated inductor 16 includes coil 42 and magnetic core 33 defined by top plate 36, bottom plate 38, and post 40 connecting top plate 36 and bottom plate 38. *Id.* at 6:20–29. As shown in Figure 3, to the right of integrated inductor 16 is capacitive pressure sensor 18. *Id.* at 7:26–27. Capacitive pressure sensor 18 includes diaphragm 64 which constitutes the moveable electrode of pressure sensor 18. *Id.* at 7:31–33. Fixed electrode 66 of pressure sensor 18 is defined by a conductive layer formed on upper face 48 of substrate 20 immediately below diaphragm 64. *Id.* at 7:33–36. Pressure applied to the exterior or top surface of capacitive pressure sensor 18 causes diaphragm 64 to deflect downwardly toward fixed electrode 66. *Id.* at 7:66–8:2. This change in distance between diaphragm 64 and fixed electrode 66 causes a corresponding change in the capacitance between the electrodes, thereby changing the resonant frequency of the LC tank resonator. *Id.* at 1:38–45, 8:3–5.

D. Challenged Claims

Petitioner challenges claims 1–5, 21–29, and 31 of the ’670 patent. Pet. 1. Independent claim 1, the sole independent claim of the ’670 patent, is illustrative of the claimed subject matter, and we reproduce it below, adding indentations and the Petitioner’s labels.

> 1. [1pre] An implantable microfabricated sensor device for measuring a physiologic parameter of interest within a patient, said sensor comprising:
>
> [1a] an implantable sensing device, said sensing device being a micro electromechanical system (MEMS) comprising
>
> [1b] a substrate,
>
> [1c] an integrated inductor formed on the substrate,
>
> [1d] at least one sensor responsive to the physiologic parameters and being formed at least in part on the substrate,
>
> [1e] a plurality of conductive paths electrically connecting said integrated inductor with said sensor,
>
> [1f] said integrated inductor, said sensor and said conductive paths cooperatively defining an LC tank resonator.

Ex. 1001, 14:22–35.

E. Evidence

Petitioner relies on the following references in asserting that claims 1–5, 21–29, and 31 of the ’670 patent are unpatentable. Pet. 3.

Reference	**Exhibit No.**
Orhan Şevket Akar, *Silicon Micromachined Capacitive Pressure Sensors for Industrial and Biomedical Applications* (Sept. 1998) (Master’s thesis, Graduate School of Natural and Applied Sciences of the Middle East Technical University) (“Akar”)	1010
U.S. Patent No. 6,278,379 B1 issued Aug. 21, 2001 (“Allen”)	1009
U.S. Patent No. 5,488,869 issued Feb. 6, 1996 (“Renaud”)	1011

Petitioner also relies on the Declaration of Dr. Mark Allen (Ex. 1024),[1] as well as the Declaration of Dr. Ingrid Hsieh-Yee (Ex. 1022).

[1] Dr. Allen is listed as an inventor in Allen, on which Petitioner relies in asserting the challenged claims are unpatentable. Ex. 1024 ¶ 15; Ex. 1009, code 75.

F. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability. Pet. 3.

Claim(s)	**Basis**	**Reference(s)**
1–4, 21, 26, 27, 31	35 U.S.C. § 102[2]	Akar
1–5, 21–25, 28, 29, 31	35 U.S.C. § 102[3]	Allen
26, 27	35 U.S.C. § 103	Allen, Renaud[4]

III. ANALYSIS

A. Standing

Pursuant to 37 C.F.R. § 42.104(a), Petitioner certifies that the ’670 patent is available for *inter partes* review, and that Petitioner is not barred or estopped from requesting *inter partes* review of the ’670 patent. Pet. 3. Based on the present record, we determine Petitioner has standing to request *inter partes* review of the ’670 patent.

B. Discretion

Under 35 U.S.C. § 314(a), the Director has discretion to deny institution of an *inter partes* review. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) (“[T]he agency’s decision to deny a petition is a

[2] Petitioner asserts Akar qualifies as prior art under 35 U.S.C. § 102(b). Pet. 19.

[3] Petitioner asserts Allen qualifies as prior art under 35 U.S.C. §§ 102(a) and (e). Pet 43.

[4] Petitioner asserts claims 26 and 27 are unpatentable under 35 U.S.C. § 103 in view of “Allen-379 in view of Renaud, with or without Park.” Pet. 3. In its arguments for this asserted ground of unpatentability on pages 72–80 of the Petition, however, Petitioner never mentions Park. Given the absence of any analysis regarding Park, we understand this asserted ground of does not include Park.

matter committed to the Patent Office's discretion."); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018) ("[Section] 314(a) invests the Director with discretion on the question whether to institute review . . . ." (emphasis omitted)); *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."). As set forth in the Board's Consolidated Trial Practice Guide (USPTO, *Patent Trial and Appeal Board Consolidated Trial Practice Guide November 2019*, https://www.uspto.gov/TrialPracticeGuideConsolidated, "TPG"), apart from the statutory standard for institution, the Board takes into account whether various considerations warrant the exercise of the Director's discretion to decline to institute an *inter partes* review. TPG 55.

Parallel petitions challenging the same patent may warrant discretionary denial of one more of the petitions. TPG 59. "Based on the Board's experience, one petition should be sufficient to challenge the claims of a patent in most situations." *Id.* "Two or more petitions filed against the same patent at or about the same time (e.g., before the first preliminary response by the patent owner) may place a substantial and unnecessary burden on the Board . . . ." *Id.*

Petitioner is challenging the '670 patent in this proceeding, as well as in IPR2019-01338. Although Petitioner has filed parallel Petitions challenging the same patent, Petitioner explains that the Petitions challenge different claims on different grounds. Pet. 81–84. In particular, the Petition in the present proceeding challenges claims 5, 22–25, 28, and 29, which are not challenged in the other proceeding. Furthermore, the grounds in the present proceeding are based principally on Akar and Allen, whereas the grounds in the other proceeding and based primarily on Petersen and Park.

Per Petitioner, each Petition includes at least one ground of unpatentability based on prior art under 35 U.S.C. § 102(e) and at least one ground based on prior art under § 102(b) in case Patent Owner is able to swear behind the prior art under § 102(e). *Id.* at 83. Petitioner also argues the related district court litigation is in an early stage such that considering the different asserted grounds of unpatentability in the Petitions would not be wasteful of the Board's resources. *Id.*

Petitioner's arguments have merit. In IPR2019-01338, Petitioner challenges eight claims and asserts four grounds of unpatentability, two based on Petersen and two based on Park. In the present proceeding, Petitioner challenges fifteen claims and asserts three grounds of unpatentability, one based on Akar and two based on Allen. Patent Owner has not filed a preliminary response in either proceeding. Given that the primary references in each Petition have different bases for availability as prior art under § 102, the burden on the Board is outweighed by Petitioner's reasonable precaution taken in case Patent Owner can antedate a reference. Addressing the challenges in both Petitions will provide a timely, fair, and efficient resolution for both parties before the Board, and may ultimately be helpful in reducing issues related to patentability and resolving the dispute in the district court litigation. Accordingly, we decline to exercise discretion to deny Petitioner's request for *inter partes* review in this proceeding in view of the parallel proceeding.

C. Level of Ordinary Skill in the Art

Petitioner asserts a person of ordinary skill in the art would "have had at least a bachelor's degree in electrical or mechanical engineering (or equivalent) and at least two years' industry experience, or equivalent research." Pet. 18–19. Petitioner further asserts a person of ordinary skill in the art "could substitute directly relevant additional education for experience, e.g., an advanced degree relating to the design of implantable medical devices, or an advance degree in electrical or mechanical engineering (or equivalent), with at least one year of industry experience." *Id.* at 19 (citing Ex. 1024 ¶ 34).

Petitioner's proposed level of ordinary skill in the art is consistent with our review of the '670 patent and the prior art asserted in this proceeding. Based on the record at this stage in the proceeding, we adopt Petitioner's definition of the level of ordinary skill in the art for the purposes of this Decision.

D. Claim Construction

We interpret a claim "using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b).[5] Under this standard, we construe the claim "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." *Id.* Furthermore, at this stage in the proceeding, we expressly construe the claims to the extent necessary to determine whether to institute *inter partes* review. *See Nidec Motor Corp. v.*

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[5] The Office has changed the claim construction standard in AIA proceedings to replace the broadest reasonable interpretation ("BRI") standard with the same claim construction standard used in a civil action in federal district court. *Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board*, 83 Fed. Reg. 51340 (Oct. 11, 2018). The change applies to petitions filed on or after November 13, 2018. *Id.* The present Petition was filed on July 15, 2019, so we construe the claims in accordance with the federal district court standard, now codified at 37 C.F.R. § 42.100(b).

Zhongshan Broad Ocean Motor Co. Ltd., 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner offers construction of two claim terms, "integrated inductor" and "micro electromechanical system (MEMS)." Pet. 12–17. On this record, we need not address Petitioner's proposed constructions because the meanings of these terms are not in controversy, nor are they necessary for our determination of whether to institute *inter partes* review of the '670 patent.

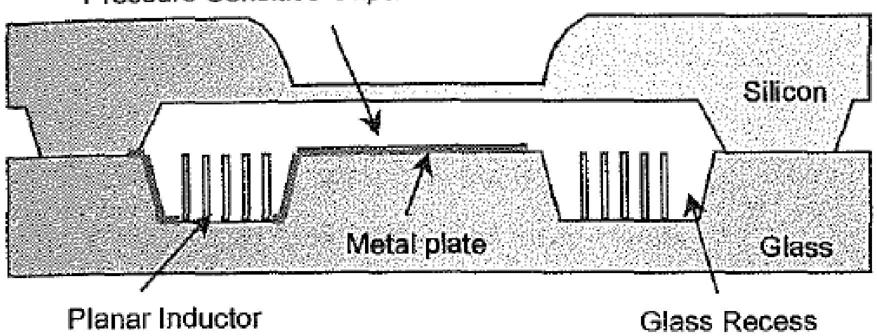
E. Anticipation Based on Akar

Petitioner challenges claims 1–5, 21, 26, 27, and 31 of the '670 patent under 35 U.S.C. § 102(b) as anticipated by Akar. Pet. 19–43. We begin our analysis with an overview of Akar, and then discuss Petitioner's contentions for each of the claims.

1. Akar (Ex. 1010)

Petitioner asserts Akar is a master's thesis that was sufficiently accessible to those interested in the art more than one year prior to the '670 patent filing date and, therefore, qualifies as prior art under 35 U.S.C. § 102(b). Pet. 19–21. In particular, Petitioner contends the "Machine-Readable Cataloging" (MARC) record for Akar demonstrates that a person of ordinary skill in the art could have electronically searched and found Akar on November 18, 1998, making it publically available by late November 1998, more than two years prior to the earliest filing priority date of the ’670 patent. *Id.* at 19 (citing Ex. 1022 ¶¶ 28–34).[6] On this record, we find Petitioner has made a sufficient showing for purposes of institution that Akar qualifies as prior art.

Akar discloses miniature micromachined capacitive pressure sensors for biomedical applications. Ex. 1010, 9. Figure 1.4(a) shows a biomedical type wireless capacitive pressure sensor, and we reproduce Figure 1.4(a) below.



(a)

Figure 1.4(a) is a cross-section view of a biomedical type wireless capacitive pressure sensor showing a glass substrate, planar inductor located within a recess of the glass substrate, and a pressure sensitive capacitor. *Id.* at 8. According to Akar, the planar inductor being recessed in the substrate integrates the inductor with the sensor capacitor to form an LC resonant circuit, and the change in resonance frequency due to capacitance change is

[6] Petitioner contends a person of ordinary skill in the art could have “electronically searched by keyword and found Akar on November 18, *2018*, which would have made it publicly available by late November, *1998*.” Pet. 19 (emphasis added). We understand that Petitioner’s reference to November 18, 2018, is a typographical error, and that Petitioner intended November 18, 1998, in view of the reference to November 1998 in the same sentence, as well as the cited portions of Dr. Hsieh-Yee’s Declaration, which similarly reference 1998.

sensed remotely with inductive coupling, thereby eliminating the need for wire connection. *Id.*

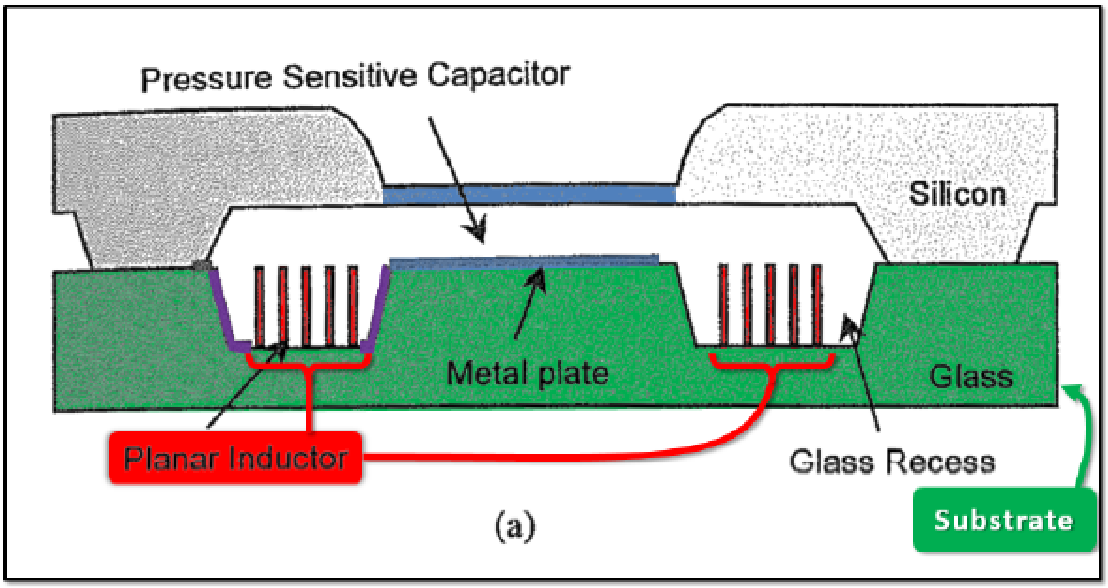
2. Independent Claim 1

The preamble of independent claim 1 recites "[a]n implantable microfabricated sensor device for measuring a physiologic parameter of interest within a patient" ("[1pre]"). Ex. 1001, 14:23–25. Petitioner asserts "Akar discloses the design and fabrication of 'micromachined capacitive pressure sensors' for 'biomedical applications as an implantable pressure sensor.'" Pet. 23 (emphasis omitted) (citing Ex. 1010, iii, iv, 3, 7–8, 73). Per Petitioner, micromachining is a type of microfabrication. *Id.* (citing Ex. 1003, 1; Ex. 1004, 2; Ex. 1024 ¶¶ 77–81, 132–133). Petitioner also asserts "Akar teaches that the sensor can be 'placed in a body or blood vessels, and allows it to measure the pressure' of the body or blood vessels (which are 'physiologic parameters of interest within a patient') 'remotely, without a need for wire connection.'" *Id.* at 24 (citing Ex. 1010, 1, 7, 9; Ex. 1024 ¶ 134).

According to independent claim 1, the sensor comprises "an implantable sensing device, said sensing device being a micro electromechanical system (MEMS)" ("[1a]"). Ex. 1001, 14:26–27. Petitioner argues Akar discloses this limitation for the same reasons Akar discloses the preamble. Pet. 24. Petitioner additionally argues Akar discloses that its sensing device is possible due to MEMS technology. Pet. 24–25 (citing Ex. 1010, iii, iv, 1–3, 8, 9, 29–30, 33, 35–42, 74, Figs. 1.4, 1.5, 3.7; Ex. 1024 ¶¶ 135–137).

Independent claim 1 further recites that the sensing devices comprises "a substrate" ("[1b]"). Ex. 1001, 14:28. Petitioner argues Akar discloses a glass substrate for a fabricated pressure sensor. Pet. 25–26 (citing Ex. 1010, iii, 8, 24, 32–33, 35, 38–39, Figs. 1.5, 3.7(a), 4.10; Ex. 1024 ¶¶ 138–139).

Independent claim 1 also recites "an integrated inductor formed on the substrate" ("[1c]"). Ex. 1001, 14:28–29. For this limitation, Petitioner relies on Akar's disclosure of an integrated inductor placed on the glass substrate as shown in annotated Figure 1.4(a) reproduced below. Pet. 26–29 (citing Ex. 1010, 8, 11, 22–25, 35, 53, 74, Figs. 1.4(a), 1.5, 3.7(a), 4.10; Ex. 1024 ¶¶ 140, 142).



Akar's Figure 1.4(a) is a cross-section view of the pressure sensor, and Petitioner annotated the figure to identify the planar inductor in red and the substrate in green. *Id.* at 27; Ex. 1010, 8. As shown in the figure, the planar inductor is located within a recess of the substrate. Petitioner also argues Akar discloses the inductor is microfabricated with the sensor itself. Pet. 29 (citing Ex. 1010, 8–9, 38–39; Ex. 1024 ¶ 141).

Independent claim 1 further recites "at least one sensor responsive to the physiologic parameters and being formed at least in part on the substrate" ("[1d]"). Ex. 1001, 14:30–31. Petitioner contends Akar discloses a pressure sensor device with a pressure sensitive capacitor formed by a thin silicon diaphragm and a metal plate on the substrate. Pet. 30 (citing Ex. 1010, 7–8; Ex. 1024 ¶¶ 143–144). According to Petitioner, the thin silicon diaphragm deflects downwardly in response to pressure, thereby coming closer to the metal plate and increasing the value of the variable capacitor. *Id.* (citing Ex. 1010, 7–8). Petitioner also argues Akar discloses "the measurement of 'physiologic parameters' remotely as a 'change in the resonance frequency due to capacitance change.'" *Id.* (citing Ex. 1010, 1, 7–8; Ex. 1024 ¶¶ 145, 147). Figure 1.4(a) shows the pressure sensor, and we reproduce Petitioner's annotated version of Figure 1.4(a) below. *Id.* at 31 (citing Ex. 1010, 8, Fig. 1.4(a); Ex. 1024 ¶ 146).

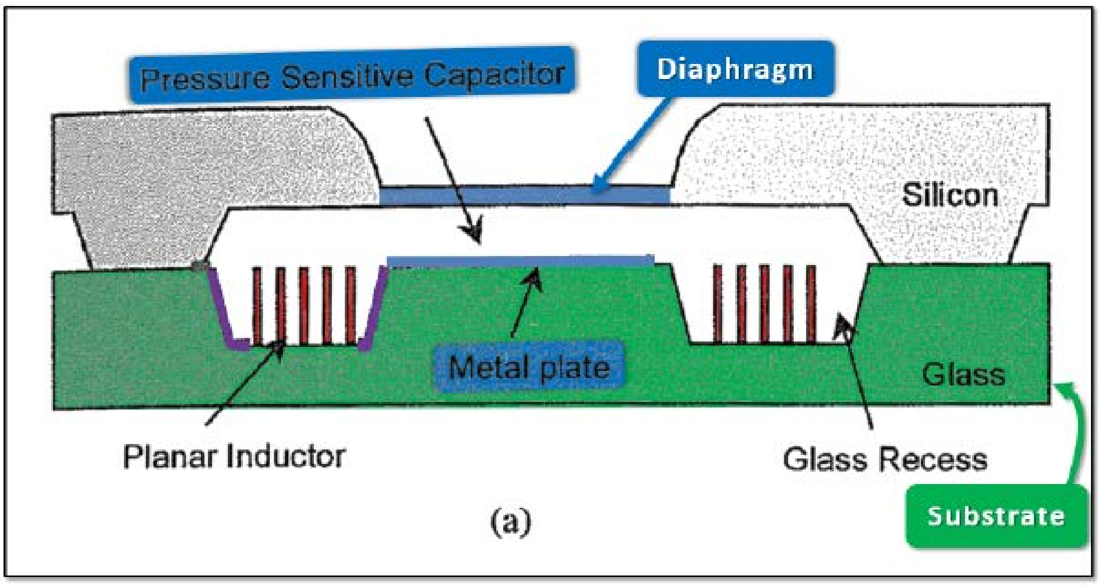


Figure 1.4(a) shows a cross-section of the pressure sensor, and Petitioner annotated the figure to identify the substrate in green, the inductor in red, and the pressure sensitive capacitor in blue. *Id.* at 31; Ex. 1010, 8. As shown in the annotated figure, the pressure sensitive capacitor includes a metal plate formed on the substrate, and further includes a diaphragm located above and spaced apart from the metal plate.

Independent claim 1 additionally recites "a plurality of conductive paths electrically connecting said integrated inductor with said sensor" ("[1e]"). Ex. 1001, 14:31–33. In arguing that Akar discloses this limitation, Petitioner proffers annotated versions of Akar's Figures 1.4(a) and 1.4(b), and we reproduce the annotated figures below. Pet. 32 (citing Ex. 1010, 8, Figs. 1.4(a), 1.4(b); Ex. 1024 ¶ 149).

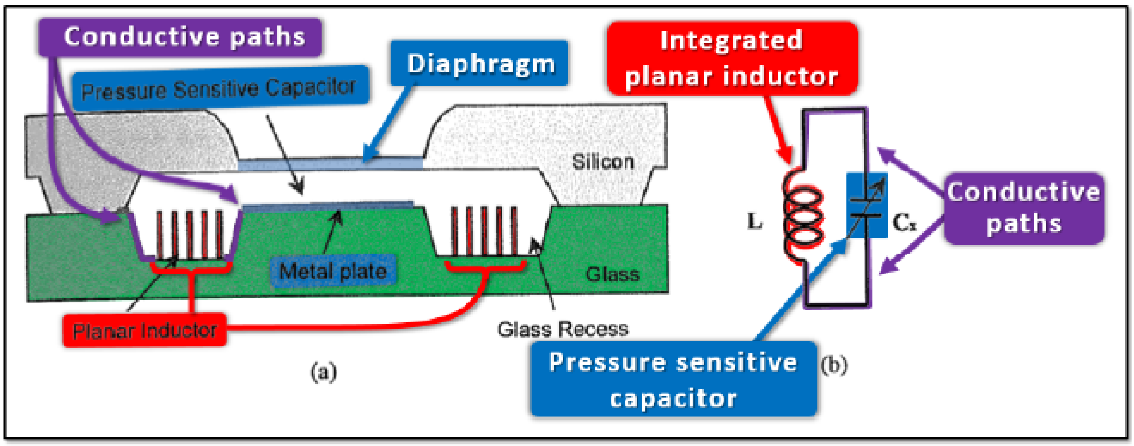


Figure 1.4(a) is a cross-section view of the pressure sensor, and Figure 1.4(b) is a schematic showing the electrical equivalent of the sensor. Ex. 1010, 8. Petitioner annotated both figures to show the substrate in green, the planar inductor in red, the pressure sensitive capacitor in blue, and the conductive paths in purple. Pet. 32. According to Petitioner, via the conductive paths, one end of the integrated inductor coil is connected to the fixed plate of the capacitor, and the other end of the coil touches the silicon, which includes the diaphragm of the capacitor sensor. *Id.* (citing Ex. 1010, 29–30, 33). Petitioner also argues that, in Akar's sensor, both ends of the inductor coil and the capacitor are short-circuited and form an LC resonant circuit. *Id.* (citing Ex. 1010, 7–8, 32, 33; Ex. 1024 ¶¶ 150–152).

The last limitation of independent claim 1 recites "said integrated inductor, said sensor and said conductive paths cooperatively defining an LC tank resonator" ("[1f]"). Ex. 1001, 14:33–35. Petitioner asserts "Akar's integrated planar inductor (*see* limitation [1c] above), pressure sensitive capacitor (*see* limitation [1d] above) and conductive paths (*see* limitation [1e] above) together define an LC tank resonator as claimed." Pet. 34. Petitioner also contends Akar discloses an LC tank resonator. *Id.* at 35 (citing Ex. 1010, 8, 9, 33, 74, Figs. 1.4(a), 1.4(b); Ex. 1024 ¶¶ 38, 154).

Based on the record at this stage of the proceeding, Petitioner has demonstrated persuasively that Akar discloses each limitation of independent claim 1. Our review of Akar is consistent with Petitioner's arguments, and Petitioner's arguments are supported by Dr. Allen's testimony. For example, we agree with Petitioner that Akar discloses a MEMS sensor that can be implanted in a body or blood vessel to measure pressure. Ex. 1010, 1–4, 7, 74. We also agree Akar's sensor comprises a substrate, an integrated inductor, at least one sensor responsive to a physiologic parameter and being formed at least in part on the substrate, and a plurality of conductive paths electrically connecting the integrated inductor and sensor, whereby the integrated inductor, sensor, and conductive paths define an LC tank resonator. *Id.* at 7–8, Figs. 1.4(a), 1.4(b). Petitioner, therefore, has shown a reasonable likelihood that Petitioner would prevail in demonstrating that independent claim 1 is anticipated by Akar under 35 U.S.C. § 102(b).

3. Dependent claims 2–4, 21, 26, 27, and 31

Petitioner argues Akar discloses each limitation of each of claims 2–4, 21, 26, 27, and 31. Pet. 35–43. Based on the record at this stage of the proceeding, we are persuaded Petitioner has established a reasonable likelihood that claims 2–4, 21, 26, 27, and 31 are anticipated by Akar under 35 U.S.C. § 102(b).

F. Anticipated Based on Allen

Petitioner challenges claims 1–5, 21–25, 28, 29, and 31 of the ’670 patent under 35 U.S.C. §§ 102(a) and (e) as anticipated by Allen. Pet. 43–72. We begin our analysis with an overview of Allen, and then turn to Petitioner’s contentions for each of the claims.

1. Allen (Ex. 1009)

Allen is a U.S. patent that issued on August 21, 2001. Ex. 1009, code 45. Allen has a filing date of December 6, 1999, and claims priority, as a continuation-in-part, to U.S. application number 09/054,011, filed on April 2, 1998, now U.S. patent number 6,111,520. *Id.* at code 63. Petitioner contends Allen is prior art under 35 U.S.C. § 102(e) because it is a U.S. patent filed before the ’670 patent’s actual and earliest-claimed filing dates. Pet. 43. Petitioner also contends Allen is prior art under § 102(a) because it issued before the ’670 patent’s actual filing date. *Id.* On this record, we find Petitioner has made a sufficient showing for purposes of institution that Allen qualifies as prior art at least under § 102(e).

Allen discloses a pressure sensor featuring an inductive-capacitive (LC) resonant circuit with a variable capacitor. Ex. 1009, 2:16–55. Allen also discloses a similar temperature sensor. *Id.* at 2:30–37. The sensor may be used for medical applications to sense physical properties within the body. *Id.* at 26:18–21. Figure 21B, reproduced below, depicts the sensor. *Id.* at 7:30–31.

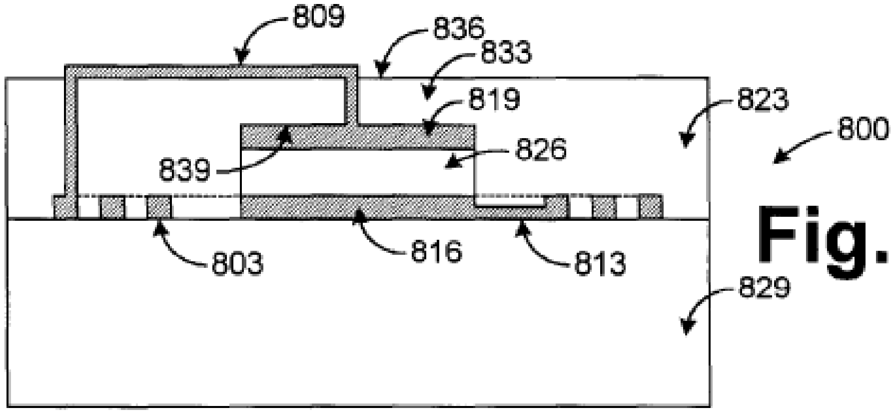


Fig. 21B

Figure 21B is a side view of a pressure sensor in a surface machined configuration. *Id.* at 7:30–31. As shown in the figure, sensor 800 includes inductor coil 803 and capacitor 806 forming a resonant circuit. *Id.* at 19:18–22. Inductor coil 803 and capacitor 806 are electrically coupled via first connector 809 and second connector 813. *Id.* at 19:22–24.

According to Allen, sensor 800 includes substrate 829 with inductor coil 803 disposed on the substrate. *Id.* at 19:30–33. Sensor 800 further includes capacitor 806 with first plate 816 affixed to substrate 829, and second plate 819 affixed to interior surface 839 of diaphragm 833. *Id.* at 19:38–42. Allen discloses "[t]he movement of the diaphragm 833 causes corresponding movement of the second plate 819 thereby altering the capacitance of the capacitor 806 due to the fact that the first and second plates 816 and 819 have a variable relative position depending on the pressure applied to the external surface 836." *Id.* at 19:42–47.

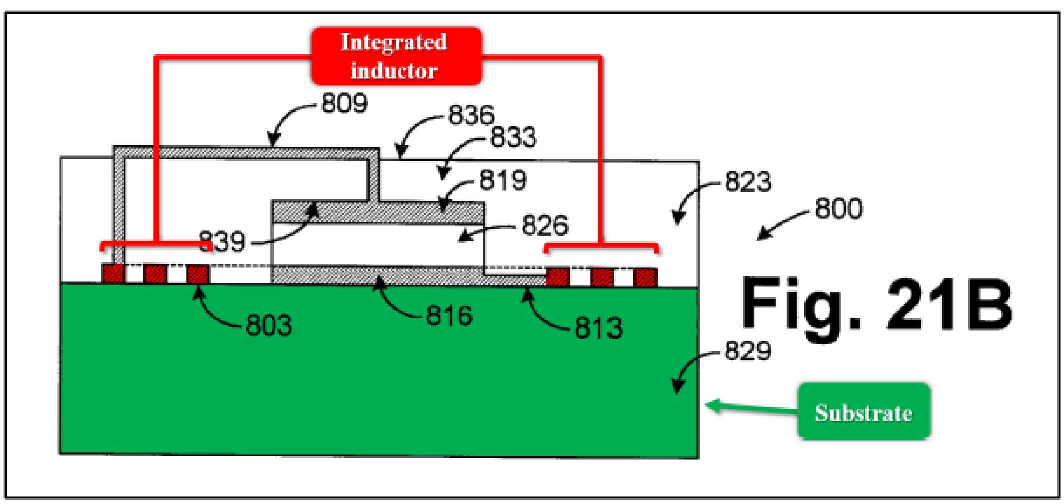
2. Independent Claim 1

Petitioner asserts Allen discloses the preamble of independent claim 1 because Allen teaches pressure and temperature sensors manufactured by fabrication and micromachining techniques used for medical purposes to measure physical properties in the body. Pet. 46–47 (citing Ex. 1003, 1; Ex. 1004, 2; Ex. 1009, 2:16–20, 30–32, 9:5–15, 10:60–64, 26:18–23;

Ex. 1024 ¶¶ 78–82, 289–292). For limitation [1a], Petitioner argues Allen's sensing devices, such as those shown in Figures 21A–B and 24A, are MEMS devices because the devices are surface micromachined resonant circuits that perform a mechanical movement. Pet. 48–49 (citing Ex. 1003, 1; Ex. 1004, 2; Ex. 1009, 9:33–35, 10:60–64, 19:17–47, 20:17–42, 21:34–65; Ex. 1024 ¶¶ 294–295).

For the substrate recited in limitation [1b], Petitioner contends Allen discloses pressure sensor 800 with substrate 829. Pet. 49 (citing Ex. 1009, 19:30–33, Fig. 21B; Ex. 1024 ¶ 296). Petitioner similarly contends Allen discloses temperature sensor 900 formed on substrate 909. *Id.* at 50 (citing Ex. 1009, 5:2–9, 21:36–41, Fig. 24A; Ex. 1024 ¶ 297).

For the integrated inductor recited in limitation [1c], Petitioner asserts Allen "discloses its pressure sensor 800 'includes a resonant circuit that comprises an inductor coil 803' that is 'disposed on' the surface of substrate 829 as shown in annotated Figure 21B." Pet. 50–51 (citing Ex. 1009, 19:20–22, 19:30–34; Ex. 1024 ¶ 298). We reproduce Petitioner's annotated version of Figure 21B below.



Allen's Figure 21B is a side view of pressure sensor 800, and Petitioner annotated the figure to show the substrate in green and the integrated inductor in red. *Id.* at 51; Ex. 1009, 7:30–31. Petitioner also contends "Allen[]'s temperature sensor 900 includes an integrated inductor 903 formed on the substrate 909, as shown in annotated Figure 24A." Pet. 52. We reproduce Petitioner's annotated version of Figure 24A below.

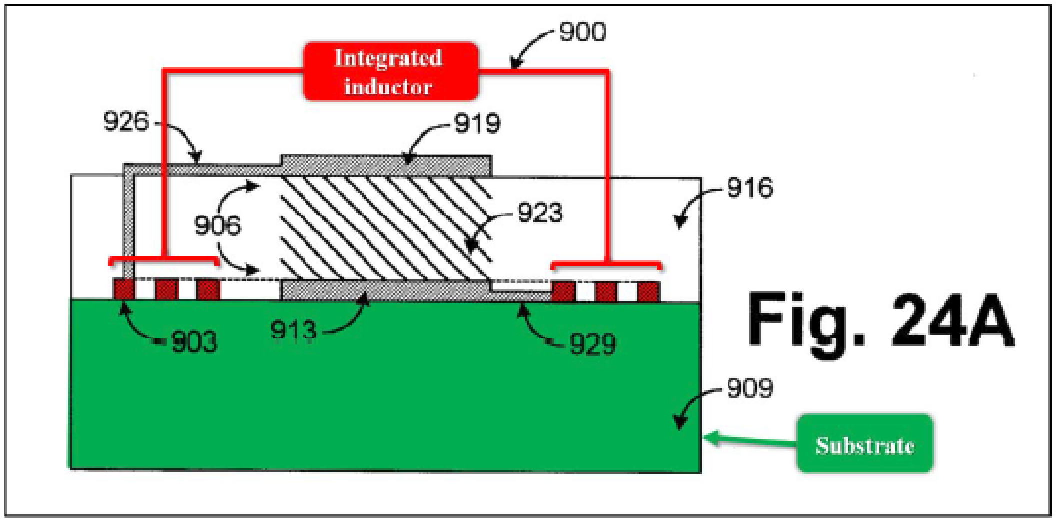


Figure 24A is a side view of temperature sensor 900, and Petitioner annotated the figure to show the substrate in green and the integrated inductor in red. *Id.* at 52; Ex. 1009, 7:38–39. Additionally, Petitioner contends Allen discloses the integrated inductor is microfabricated with the sensor itself. Pet. 52 (citing Ex. 1009, 23:64–24:6, 24:58–61; Ex. 1024 ¶ 301).

Turning to the sensor recited in limitation [1d], Petitioner relies on capacitor 806 of pressure sensor 800, as shown in Petitioner's annotated version of Figure 21B reproduced below. Pet. 53 (citing Ex. 1009, 19:18–47, Fig. 21B; Ex. 1024 ¶ 302).

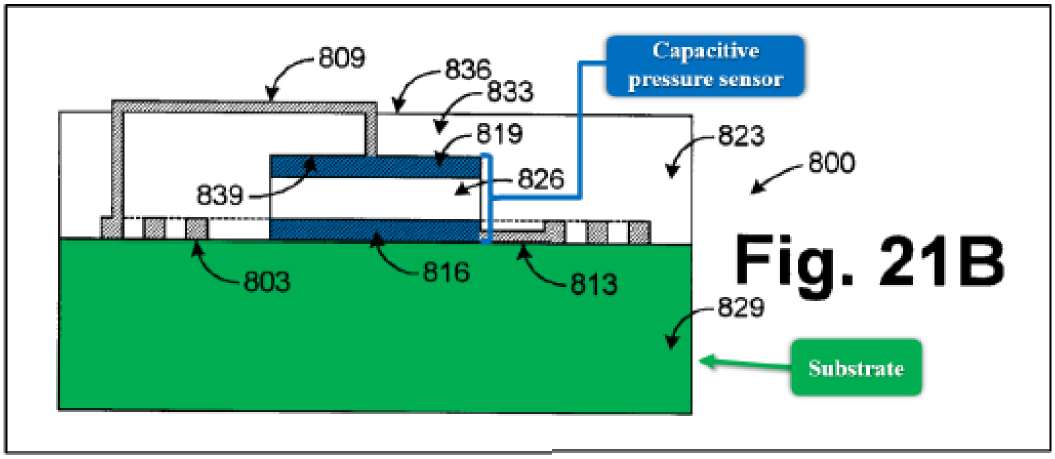


Figure 21B is a side view of pressure sensor 800, and Petitioner annotated the figure to show the capacitive pressure sensor in blue. *Id.* at 53; Ex. 1009, 7:30–31. As shown, capacitor 806 is comprised of first plate 816 and second plate 819 placed directly above first plate 816, and the first plate 816 and second plate 819 are separated by cavity 826. Pet. 53 (citing Ex. 1009, 19:20–27, 30–33, 39–42). Per Petitioner, movement of diaphragm 833, which occurs upon the application of pressure to exterior surface 836, changes the capacitance of capacitor 806 due to second plate 819 moving relative to first plate 816. *Id.* (citing Ex. 1009, 19:35–39, 42–47, 25:5–7, Fig. 29A; Ex. 1024 ¶¶ 304–305).

Petitioner also relies on Allen's capacitor 906 of temperature sensor 900, as shown in Petitioner's annotated version of Figure 24A reproduced below. Pet. 55.

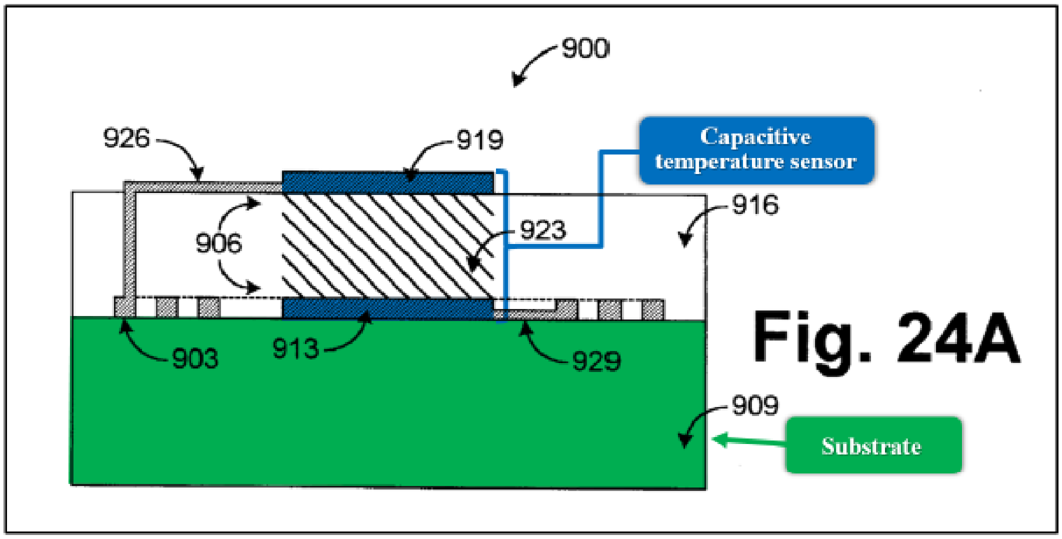


Figure 24A is a side view of temperature sensor 900, and Petitioner annotated the figure to show the capacitive temperature sensor in blue. *Id.* at 55; Ex. 1009, 7:38–39. As shown, capacitor 906 includes first plate 913 placed on substrate 909 and a second plate 919 disposed on top of structural layer 916 opposite first plate 913. Pet. 55 (citing Ex. 1009, 21:36–48, Fig. 24A; Ex. 1024 ¶ 306). According to Petitioner, the capacitance of capacitor 906 varies in response to changes in temperature in two ways: (1) the material between the first and second plates is a dielectric with a permittivity that varies with temperature, thereby causing a change in capacitance; and (2) the top plate moves due to thermal expansion effects of the dielectric material, resulting in a change in capacitance. *Id.* at 55–56 (citing Ex. 1009, 12:16–33, 21:51–54; Ex. 1024 ¶¶ 307–308).

For the conductive paths recited in limitation [1e], Petitioner argues Allen discloses first connector 809 and second connector 813 that electrically couple inductor 803 and capacitor 806 of pressure sensor 800, as shown in annotated Figure 21B reproduced below. Pet 56 (citing Ex. 1009, 19:22–24, Fig. 21B).

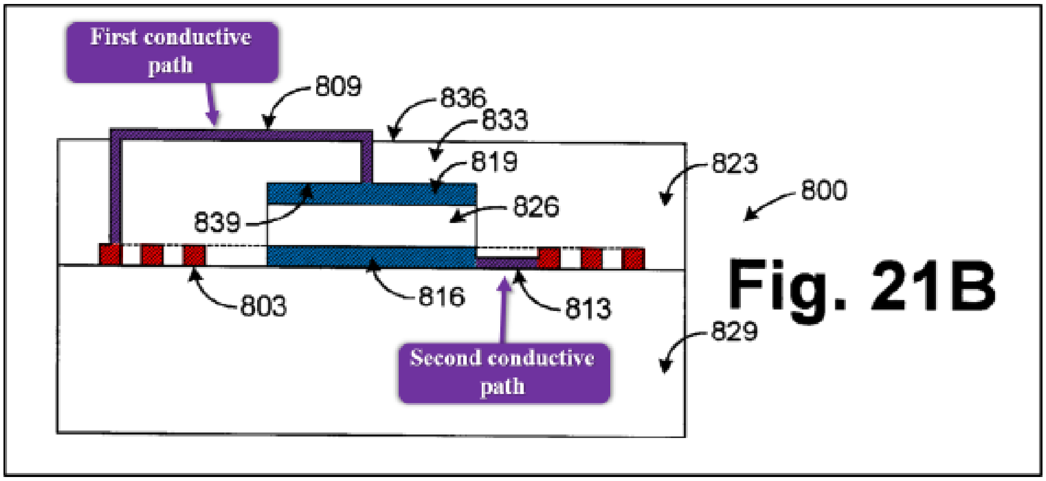


Figure 21B is a side view of pressure sensor 800, and Petitioner annotated the figure to show the conductive paths in purple, which connect the inductor shown in red and the capacitive pressure sensor in blue. *Id.* at 56; Ex. 1009, 7:30–31.

Petitioner also argues inductor coil 903 of temperature sensor 900 is electrically coupled to capacitor 906 via first and second conductive members 926 and 929 as shown in annotated Figure 24A reproduced below. Pet. 58 (citing Ex. 1009, 21:58–65, Fig. 24A; Ex. 1024 ¶ 314).

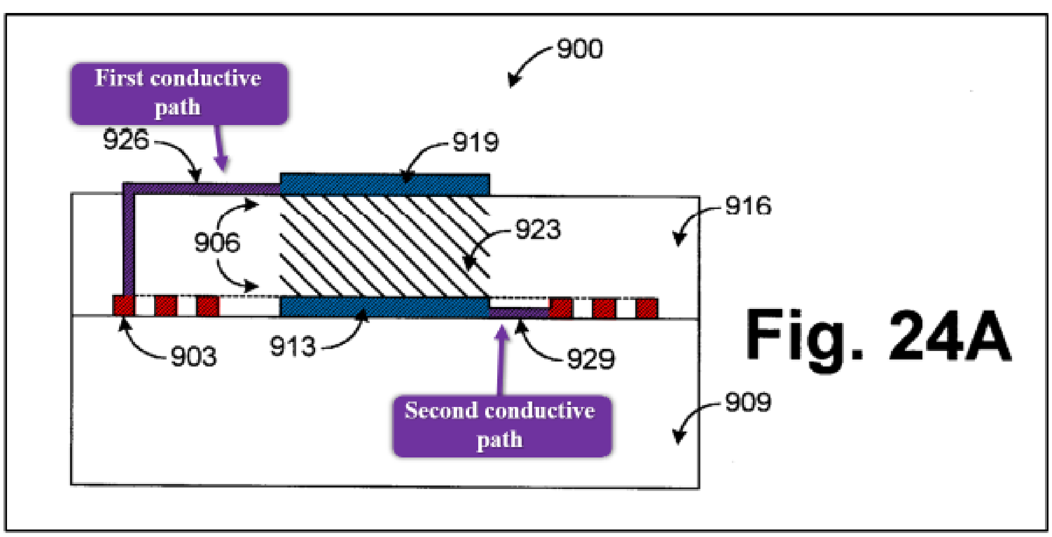


Figure 24A is a side view of temperature sensor 900, and Petitioner annotated the figure to show the conductive paths in purple, which connect the inductor shown in red and the capacitive pressure sensor in blue. *Id.* at 58; Ex. 1009, 7:38–39.

For the LC tank resonator of limitation [1f], Petitioner argues "Allen[] discloses this feature, teaching that its integrated inductor (limitation [1c] above), capacitive sensor (limitation [1d] above), and plurality of conductive paths (limitation [1e] above) together define an "inductive-capacitive (LC) resonant circuit with a variable capacitor." Pet. 58–59 (citing Ex. 1009, code 57, 2:16–25, 30–39, 3:19–30, 4:54–56, 5:3–5, 10:10–25, 12:10–35, 19:18–22, 21:31–39, 22:3–7; Ex. 1024 ¶ 315).

Based on the record at this stage of the proceeding, Petitioner has demonstrated persuasively that Allen discloses each limitation of independent claim 1. Our review of Allen is consistent with Petitioner's arguments, and Petitioner's arguments are supported by Dr. Allen's testimony. For example, we agree with Petitioner that Allen discloses a micromachined sensor for measuring physical properties in the body. Ex. 1009, 9:32–35, 10:60–64, 26:18–21. We also agree the sensor comprises a substrate, an integrated inductor, at least one sensor responsive to a physiologic parameter and being formed at least in part on the substrate, and a plurality of conductive paths electrically connecting the integrated inductor and sensor, whereby the integrated inductor, sensor, and conductive paths define an LC tank resonator. *Id.* at 2:17–44, 19:17–20:16, 21:34–22:13, Figs. 21A–F, 24A–B. Petitioner, therefore, has shown a reasonable likelihood that Petitioner would prevail in demonstrating that independent claim 1 is anticipated by Allen under 35 U.S.C. § 102(e).

3. Dependent claims 2–5, 21–25, 28, 29, and 31

Petitioner argues Allen discloses each limitation of each of claims 2–5, 21–25, 28, 29, and 31. Pet. 59–72. Based on the record at this stage of the proceeding, we are persuaded Petitioner has established a reasonable likelihood that claims 2–5, 21, 26, 27, and 31 are anticipated by Allen under 35 U.S.C. § 102(e).

G. Obviousness based on Allen and Renaud

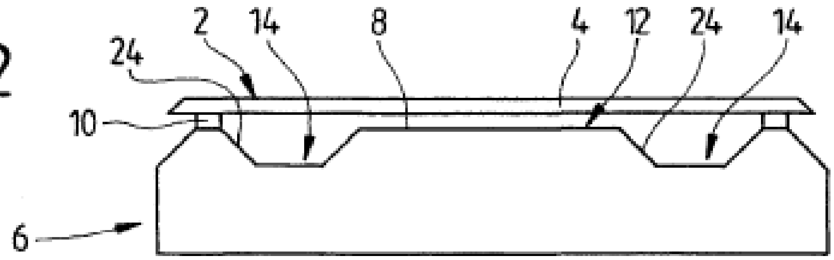
Petitioner challenges claims 26 and 27 under 35 U.S.C. § 103 as unpatentable over Allen and Renaud. Pet. 72–80. As we discuss Allen above, we begin our analysis with an overview of Renaud, and then discuss Petitioner's contentions for each of the claims.

1. Renaud (Ex. 1011)

Renaud is a U.S. patent that issued on February 6, 1996. Ex. 1011, code 45. Petitioner contends Allen is prior art under § 102(b) because it issued before the '670 patent's actual and earliest-claimed filing dates. Pet. 72. On this record, we find that Petitioner has made a sufficient showing for purposes of institution that Renaud qualifies as prior art at least under § 102(b).

Renaud discloses a capacitive pressure measurement sensor including a mobile electrode and fixed electrode. Ex. 1011, code 57. Figure 2, reproduced below, depicts a sectional view of a sensor. *Id.* at 3:40–41.

Fig. 2



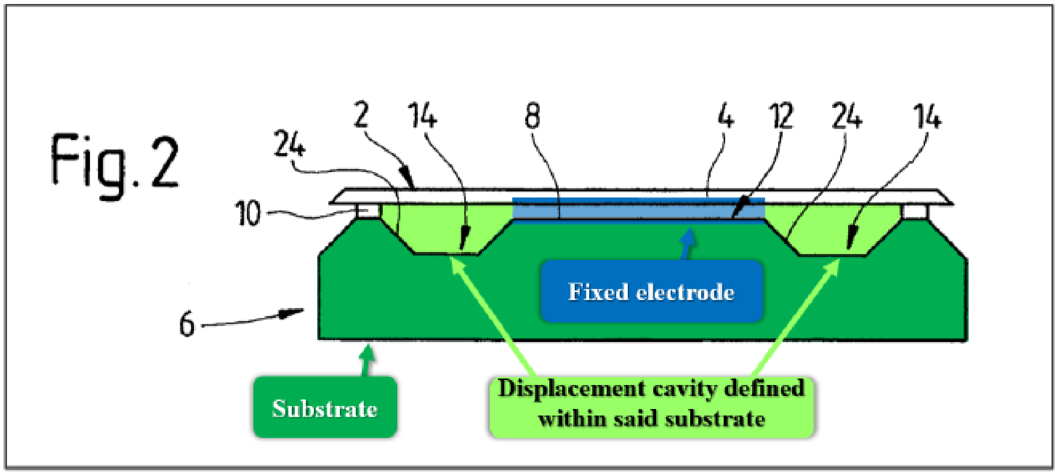
Renaud's Figure 2 shows sensor 1 including mobile electrode 4 on membrane 2 and fixed electrode 8 on substrate 6. *Id.* at 3:55–61, 4:5. "[C]onnecting frame 10 also forms a spacing frame which creates a dielectric space between the mobile electrode 4 and the fixed electrode 8 and thus forms a conventional measuring capacitor." *Id.* at 4:1–4. According to Renaud, membrane 2 and substrate 6 form chamber 12. *Id.* at 4:4–12. "The sensor also comprises a reference volume 14 in contact with the chamber 12 to reduce the pressure of the gas contained in the chamber 12 which result from the degassing which occurs during the manufacturing of the sensor 1." *Id.* at 4:13–16.

2. Claims 26 and 27

Claim 26 depends from independent claim 1, and recites "wherein said sensor is a capacitive sensor including a fixed electrode and a moveable electrode, said fixed and moveable electrodes defining a chamber therebetween, said chamber being in fluid communication with a displacement cavity." Ex. 1001, 16:1–5. Claim 27 depends from claim 26, and recites "wherein said displacement cavity is defined within said substrate." *Id.* at 16:6–7.

Petitioner contends Allen discloses a chamber between fixed and movable electrodes, i.e., cavity 826, but does not expressly disclose a displacement cavity in fluid communication with the chamber. Pet. 74.

Petitioner further contends Renaud teaches the displacement cavity recited in claims 26 and 27, as shown in Petitioner's annotated version of Renaud's Figure 2 reproduced below. *Id.* at 74–75 (citing Ex. 1011, code 57, 2:53–55, 3:56–61, 4:1–16, 55–59, 5:51–56, 6:23–30, 8:12–17, Fig. 2; Ex. 1024 ¶¶ 362–364).



Renaud's Figure 2 is a cross-sectional view of a pressure sensor having membrane 2 with moveable electrode 4 shown in blue; substrate 6 shown in green with fixed electrode 4 shown in blue; and the displacement cavity shown in light green. *Id.* at 75; Ex. 1011, 3:40–41.

Petitioner further argues Renaud teaches the use of a reference volume, i.e., displacement cavity, is known solution the problem of residual pressure in the chamber resulting from degassing within the structure of the sensor. Pet. 77–78 (citing Ex. 1011, 1:53–65; Ex. 1024 ¶¶ 370–371). Petitioner contends a person of ordinary skill in the art would have understood that applying Renaud's displacement cavity to Allen's sensor would have been obvious as a well-known solution to a common problem in a micromachined capacitive pressure sensor. *Id.* at 78–79 (citing Ex. 1024 ¶¶ 370–371).

In view of the foregoing, Petitioner shows persuasively each limitation of claims 26 and 27 in Allen and Renaud. Petitioner also articulates sufficient reasoning for why a person of ordinary skill would have combined the teachings of Allen and Renaud in the manner set forth in the Petition. Based on this record, Petitioner shows a reasonable likelihood that Petitioner would prevail in demonstrating claims 26 and 27 are unpatentable under 35 U.S.C. § 103 based on the combination of Allen and Renaud.

IV. CONCLUSION

For the reasons set forth above, Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one of the challenged claims of the ’670 patent, and we institute an *inter partes* review based on the asserted grounds of unpatentability set forth in the Petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018); *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (indicating that a decision whether to institute an *inter partes* review “require[s] a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”). At this stage of the proceeding, however, we have not made a final determination as to the patentability of any challenged claim or any underlying factual or legal issue.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a) and 37 C.F.R. § 42.4, an *inter partes* review of the ’670 patent is hereby instituted with respect to claims 1–5, 21–29, and 31 of the ’670 patent, on all grounds presented in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), notice is hereby given of the institution of a trial, which will commence on the entry date of this Decision.

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