

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS CO., LTD.  
Petitioner

v.

UUSI, LLC d/b/a NARTRON  
Patent Owner

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Patent No. 5,796,183

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**PETITION FOR *INTER PARTES* REVIEW  
OF U.S. PATENT NO. 5,796,183**

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**LIST OF EXHIBITS**

- Ex. 1001 U.S. Patent No. 5,796,183 including reexamination certificates issued on April 29, 2013 and June 27, 2014
- Ex. 1002 Declaration of Dr. Vivek Subramanian
- Ex. 1003 Curriculum Vitae of Dr. Vivek Subramanian
- Ex. 1004 Prosecution History of U.S. Patent No. 5,796,183
- Ex. 1005 Prosecution History of Reexamination Control No. 90/012,439
- Ex. 1006 Prosecution History of Reexamination Control No. 90/013,106
- Ex. 1007 U.S. Patent No. 5,087,825 to Ingraham (“*Ingraham I*”)
- Ex. 1008 U.S. Patent No. 4,731,548 to Ingraham (“*Ingraham II*”)
- Ex. 1009 U.S. Patent No. 5,594,222 to Caldwell (“*Caldwell*”)
- Ex. 1010 U.S. Patent No. 4,758,735 to Ingraham (“*Ingraham III*”)
- Ex. 1011 Walker, Fundamentals of Projected-Capacitive Touch Technology (2014)
- Ex. 1012 U.S. Patent No 5,565,658 to Gerpheide et al. (“*Gerpheide*”)
- Ex. 1013 Patent Owner’s Infringement Contentions for the ’183 patent
- Ex. 1014 Patent Owner’s Opening Claim Construction Brief
- Ex. 1015 U.S. Patent No 5,341,036 to Wheeler et al. (“*Wheeler*”)
- Ex. 1016 U.S. Patent No. 5,572,205 to Caldwell et al. (“*Caldwell ’205*”)

## I. INTRODUCTION

Samsung Electronics Co., Ltd. (“Petitioner”) requests *inter partes* review (“IPR”) of claims 37-41, 43, 45, 47, 48, 61-67, 69, 83-86, 88, 90, 91, 94, 96, 97, 99, 101, and 102 of U.S. Patent No. 5,796,183 (“the ’183 patent”) (Ex. 1001), which, on its face, is assigned to Nartron Corporation (“Patent Owner”). For the reasons set forth below, the challenged claims should be found unpatentable and canceled.

## II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

**Real Parties-in-Interest:** Petitioner identifies the following as the real parties-in-interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. **Related Matters:** Patent Owner has asserted the ’183 patent against Petitioner in *UUSI, LLC D/B/A Nartron v. Samsung Elecs. Co., Ltd. and Samsung Elecs. Am., Inc.*, No. 1:15-cv-00146-JTN (W.D. Mich.). The ’183 patent was also at issue in Ex Parte Reexamination Control Nos. 90/012,439 (certificate issued April 29, 2013) and 90/013,106 (certificate issued June 27, 2014). **Counsel and Service Information:** Lead counsel is Naveen Modi (Reg. No. 46,224), and Backup counsel is (1) Joseph E. Palys (Reg. No. 46,224) and (2) Chetan R. Bansal (Limited Recognition No. L0667). Service information is Paul Hastings LLP, 875 15th St. N.W., Washington, D.C., 20005, Tel.: 202.551.1700, Fax: 202.551.1705, email: naveenmodi@paulhastings.com; josephpalys@paulhastings.com;

chetanbansal@paulhastings.com. Petitioner consents to electronic service.

### **III. PAYMENT OF FEES UNDER 37 C.F.R. § 42.15(a)**

The PTO is authorized to charge all fees due at any time during this proceeding, including filing fees, to Deposit Account No. 50-2613.

### **IV. GROUNDS FOR STANDING**

Petitioner certifies that the '183 patent is available for IPR and Petitioner is not barred or estopped from requesting IPR on the grounds identified herein.

### **V. PRECISE RELIEF REQUESTED AND GROUNDS RAISED**

#### **A. Claims for Which Review is Requested**

Petitioner respectfully requests review of claims 37-41, 43, 45, 47, 48, 61-67, 69, 83-86, 88, 90, 91, 94, 96, 97, 99, 101, and 102 (“challenged claims”) of the '183 patent, and cancellation of these claims as unpatentable.

#### **B. Statutory Grounds of Challenge**

The challenged claims should be canceled as unpatentable in view of the following prior art: **Reference 1:** U.S. Patent No. 5,087,825 to Ingraham (Ex. 1007, “*Ingraham I*”) issued on February 11, 1992, and is prior art to the '183 patent at least under pre-AIA 35 U.S.C. § 102(b); **Reference 2:** U.S. Patent No. 4,731,548 to Ingraham (Ex. 1008, “*Ingraham II*”) issued on March 15, 1998, and is prior art to the '183 patent at least under pre-AIA 35 U.S.C. § 102(b); **Reference 3:** U.S. Patent No. 5,594,222 to *Caldwell* (Ex. 1009, “*Caldwell*”) was filed on October 25, 1994, and is prior art to the '183 patent at least under pre-AIA 35

U.S.C. § 102(e); **Reference 4:** U.S. Patent No 5,565,658 to Gerpheide et al. (Ex. 1012, “*Gerpheide*”) was filed on December 7, 1994, and is prior art to the ’183 patent at least under pre-AIA 35 U.S.C. § 102(e); and **Reference 5:** U.S. Patent No 5,341,036 to Wheeler et al. (Ex. 1015, “*Wheeler*”) issued on August 23, 1994, and is prior art to the ’183 patent at least under pre-AIA 35 U.S.C. § 102(b).

The challenged claims should be canceled as unpatentable on the following grounds: **Ground 1:** *Ingraham I*, *Caldwell*, and *Gerpheide* render claims 37-41, 43, 45, 61, 64-67, 69, 83, 85, 86, 88, 90, 91, 94, 96, 97, 99, 101, and 102 unpatentable under 35 U.S.C. § 103(a); and **Ground 2:** *Ingraham I*, *Caldwell*, *Gerpheide*, and *Wheeler* render claims 47, 48, 62, 63, and 84 unpatentable under 35 U.S.C. § 103(a).

## **VI. LEVEL OF ORDINARY SKILL IN THE ART**

A person of ordinary skill in the art at the time of the alleged invention of the ’183 patent would have had at least a B.S. degree in electrical engineering, or equivalent thereof, and at least two to three years of experience in the relevant field, which includes touch systems technology. (Ex. 1002 at ¶ 19.)

## **VII. OVERVIEW OF THE PRIOR ART & ’183 PATENT**

### **A. Technology Background**

The prior art cited in this petition and the ’183 patent generally relate to capacitive touch sensors. (Ex. 1002 at ¶¶ 26, 27.) The operation of capacitive

touch sensors was well understood at the time of the alleged invention of the '183 patent. (*Id.*) In a capacitive touch sensor that utilizes the phenomenon of “self-capacitance” as its detection mechanism, when a user touches the self-capacitance sensor, she creates an additional path to ground, thereby increasing the total capacitance between the electrode and ground. (*Id.*; Ex. 1011 at 10.) This results in an increase in current for the sensor electrode that can be measured to determine whether the touch sensor has been touched by a user. (Ex. 1002 at ¶ 27.) As discussed in detail in the sections to follow, the '183 patent and the prior art (e.g., *Ingraham I*), disclose such self-capacitance touch sensor features. (*Id.*)

#### **B. The '183 Patent**

The '183 patent relates to a capacitive responsive electronic switching circuit. (Ex. 1001 at Abstract; Ex. 1002 at ¶¶ 20-24.) Figure 4 of the '183 patent describes “a block diagram of a capacitive responsive electronic switching circuit.” (Ex. 1001 at 7:22-24.) The circuit includes an oscillator providing a periodic output signal, an input touch terminal for an operator to provide an input by proximity or touch, and a touch circuit that receives the output signal from the oscillator. (*Id.* at Fig. 4, 12:6-28.) As disclosed in connection with Figure 8 (touch circuit), when there is no touch by the operator at the touch pad, transistor 410 does not conduct. (*Id.* at 15:29-47.) When there is a touch at the touch pad, the increase in capacitance at the touch pad causes transistor 410 to conduct, which then causes

Schmitt Trigger 420 to emit a signal indicating a touch is present. (*Id.* at 15:37-47.)

**C. The Prosecution History of the '183 Patent**

The '183 patent issued from U.S. Patent Application No. 08/601,268 on August 18, 1998. (*See generally* Ex. 1004.) Nearly fifteen years after the '183 patent issued, and after development of touch screen smartphones and tablets by Petitioner and other manufacturers, Patent Owner twice sought reexamination of the '183 patent to add 85 new claims. (*See generally* Ex. 1005, 1006.) Patent Owner now pursues litigation against Petitioner on those new claims.

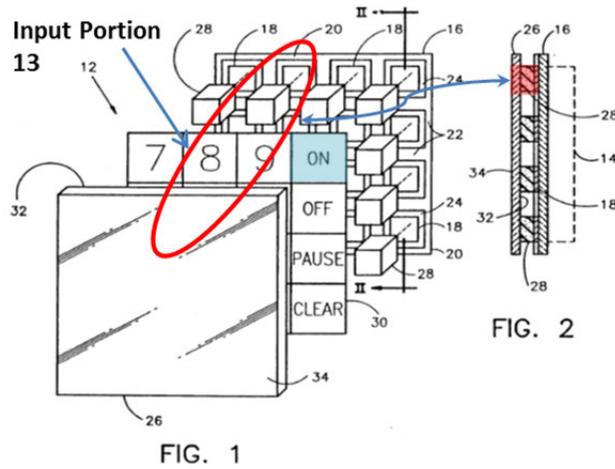
Among the references relied upon in this Petition, *Caldwell* and *Wheeler* were never considered by the Patent Office during prosecution or the reexaminations. (*See generally* Exs. 1009, 1015; *see also id.* at Ex. 1001 at References Cited.) The primary reference (*Ingraham I*) for the proposed grounds in this petition was considered by the Patent Office during prosecution and a secondary reference (*Gerpheide*) was brought to the Examiner's attention in the second re-examination. But Petitioner presents *Ingraham I* and *Gerpheide* in a new light never considered by the Office. (*See infra* Section IX.) Moreover, Petitioner presents testimony from Dr. Vivek Subramanian (Ex. 1002), who confirms that the relevant teachings of *Ingraham I* in combination with *Caldwell*, *Gerpheide*, and *Wheeler* discloses what is claimed by the challenged claims of the

'183 patent. (*See* Ex. 1002.) As such, consideration of *Ingraham I* and *Gerpheide* by the Patent Office should not preclude the Office from considering and adopting the grounds in this petition that involve these references.

**D. *Ingraham I***

*Ingraham I* (Ex. 1007) discloses a “capacity response keyboard.” (Ex. 1007, Abstract; Ex. 1002 at ¶ 28.) The keyboard consists of “capacity responsive switches” “that respond to the change in capacity from a user touching a surface portion of the switch.” (Ex. 1007 at 1:5-9.) *Ingraham I* discloses a capacity responsive keyboard system 10, which includes a touch plate assembly 12 (Fig. 2) and a control circuit 14 (Fig. 3) connected with touch plate assembly 12. (*Id.* at Figs. 2, 3, 2:28-35.) The capacitive responsive keyboard system 10 controls actuation of a “load 69 such as an electric motor.” (*Id.* at Fig. 3, 2:32-35.) Touch plate assembly 12 includes “includes a substrate 16 on which a plurality of electrically conductive plate members 18 are mounted on one surface thereof.” (*Id.* at 2:40-43.) The touch pad assembly 12 includes multiple “input portions 13” and an indicia layer 30 adhering to the back surface 32 of dielectric member 26 to “provide an indication of the function of each input portion 13.” (*Id.* at Figs. 1, 2, 2:64-67.) One of ordinary skill in the art would have understood that a single input portion 13 (e.g., the red oval in demonstrative A below) constitutes the combination of a portion of the dielectric member 26, indicia 30, a transmission

member 18, plate member 18.” (Ex. 1002 at ¶ 29 .)



**DEMONSTRATIVE A**

(Ex. 1007 at Figs. 1, 2, (annotated); Ex. 1002 at ¶ 29.)

When the user touches an input portion 13 by touching the “outwardly-facing surface 34 of dielectric member 26, the capacity-to-ground for the corresponding plate member 18 is increased substantially, as illustrated by capacitor 42 in FIG. 3.” (Ex. 1007 at 3:1-6, 3:21-47.) This increase in the capacitance is detected by a touch sensing circuit (annotated in blue in demonstrative B below), which accordingly provides an output signal on line 57 to microcomputer 80. (*Id.* at Fig. 3; Ex. 1002 at ¶ 30.)

**DEMONSTRATIVE B**

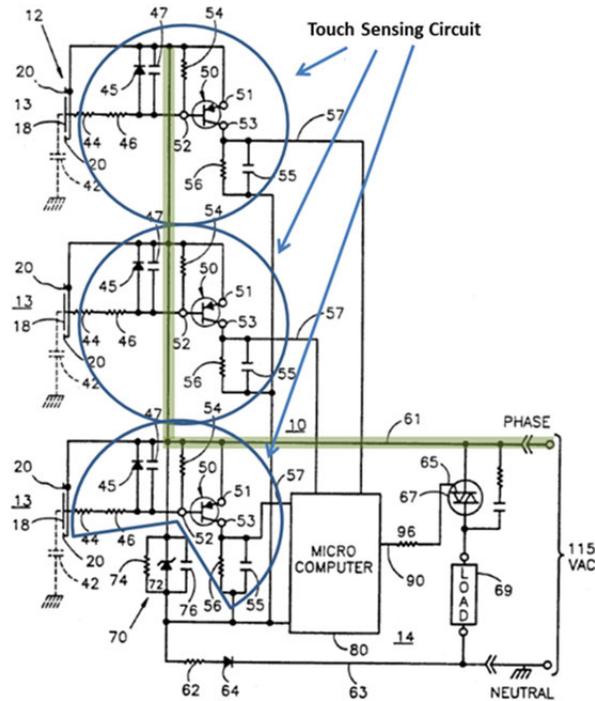


FIG. 3

(Ex. 1007 at Fig. 3 (annotated); Ex. 1002 at ¶ 30.) Each of the touch sensing circuits including the input portion 13 receives an AC signal (annotated in green above) from the 115V AC power source. The above-described touch detection mechanism is very similar to the touch detection mechanism disclosed in the '183 patent. (Ex. 1002 at ¶¶ 31-33; Ex. 1001 at 5:43-45.)

**E. *Ingraham II* and *Ingraham III***

*Ingraham I* builds on prior patents (*Ingraham II* and *Ingraham III*) by the same inventor. (Ex. 1007 at 1:39-54.) For instance, *Ingraham I* incorporates by reference certain disclosure from *Ingraham II*. (*Id.* at 3:21-24.) “To incorporate material by reference, the host document must identify with detailed particularity

what specific material it incorporates and clearly indicate where that material is found in the various documents.” *Advanced Display Sys., Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282–83 (Fed. Cir. 2000). Whether a patent describes material to be incorporated by reference with sufficient particularity is assessed from the perspective of a person of ordinary skill in the art. *Id.* at 1283. Moreover, citation to a specific page (e.g., by page and line number) is not necessary so long as one of ordinary skill would have understood the material specifically incorporated by reference. *See e.g., Harari v. Lee*, 656 F.3d 1331 (Fed. Cir. 2011) (statement that “the disclosures” of two identified applications “are hereby incorporated by reference” was sufficient to incorporate the applications in their entirety).

Here, while *Ingraham I* discloses a control circuit 14 (*see* Fig. 3), it does not provide a detailed explanation about the components of circuit 14. (Ex. 1007 at 3:21-24.) Instead, *Ingraham I* incorporates by reference the teachings of *Ingraham II* for purposes of control circuit 14. (*Id.*, “A detailed description of control circuit 14 is provided in U.S. Pat. No. 4,731,548, issued Mar. 15, 1988 to Ronald Ingraham, the disclosure of which is hereby incorporated herein by reference.”) One of ordinary skill in the art would have understood that *Ingraham I* identifies with particularity and specifically incorporates by reference the disclosure in *Ingraham II* regarding control circuit 14. (Ex. 1002 at ¶ 34.) Given that *Ingraham I* specifically calls out control circuit 14, one of ordinary skill in the art would have

understood that the disclosure in at least columns 2, 3 and figure 1 of *Ingraham II* relating to the control circuit 14 is incorporated by reference in *Ingraham I*. (*Id.*) While both *Ingraham I* and *Ingraham II* derive their oscillating input signal for the touch sensing circuits and input portions 13 from a 115 VAC power line, *Ingraham III* adapts the same touch sensing circuit to a portable system (e.g., for an automobile, airplane) by providing a dedicated oscillator circuit that operates on a DC supply and provides an oscillating signal to the touch terminals and the touch sensing circuitry. (Ex. 1002 at ¶¶ 35-37; compare Ex. 1007 at 3:30-47, with Ex. 1008 at Fig. 1, 2:39-3:15 and Ex. 1010 at Fig. 1, 2:48-3:10.) (Ex. 1010 at 1:32-44, 1:53-55, 2:21-60.)

**F. *Caldwell***

*Caldwell* discloses a touch panel that includes a touch sensor that detects user contact. (Ex. 1002 at ¶ 38; Ex. 1009 at 1:6-9.) The configuration of an individual pad is described with reference to figures 1 and 2. (Ex. 1009 at Figs. 1, 2, 3:24-29.) Dielectric substrate 10 has a front surface 12, where a user contacts the touch pad, and a back surface 14 where center electrode 16 and outer electrode 18 are formed. (*Id.* at 4:11-19, Figs. 1, 2.) A strobe line 22 is connected to the outer electrode 18 to provide a strobe signal, which is an oscillating square wave generated by an oscillator 30. (*Id.* at 4:39-51, 6:40-53, Figs. 1, 12.) A sense electrode 24 is also provided for every touch pad for carrying a detection signal

from the touch pad to the detection circuitry. (*Id.* at 5:3-6, Fig. 1.) Figure 6 shows a matrix of touch pads that constitutes a touch panel. (*Id.* at 5:60-61.) The system of *Caldwell* (*see* Fig. 12) sequentially monitors each of the touch pads in this matrix by providing a strobe signal on strobe electrodes 22 to a row (or column) of touch pads and then sequentially selecting columns (or rows) of sense electrodes 24 to sense the signal output from the touch pad (*see* Fig. 5). (*Id.* at 6:40-63; *see id.* at Fig. 6; Ex. 1002 at ¶¶ 39-40.)

### **VIII. CLAIM CONSTRUCTION**

The '183 patent expired on January 31, 2016. Accordingly, the claims of the '183 patent should be construed under the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). *See, e.g., Square Inc. v. J. Carl Cooper*, IPR2014-00156, Paper No. 38 at 7 (May 14, 2015) (citing *In re Rambus, Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012)). Under *Phillips*, claim terms are given their ordinary and customary meanings, as would be understood by a person of ordinary skill in the art, at the time of the invention, having taken into consideration the language of the claims, the specification, and the prosecution history of record. *See, e.g., Cisco Systems, Inc., v. AIP Acquisition, LLC*, IPR2014-00247, Paper No. 20 at 2-3 (July 10, 2014). The Board, however, only construes the claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport*

*Systems, Inc.*, IPR2014-00633, Paper No. 11 at 16 (August 14, 2015) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

In the corresponding district court litigation, Petitioner and Patent Owner proposed constructions for the terms listed below. Because as discussed below, the prior art discloses the claimed features under either party's construction, the Board need not construe these terms in this proceeding. Should the Board need to construe one of the below list terms, it should adopt Petitioner's constructions because they are consistent with the language of the claims, specification, and prosecution history under *Phillips*.

Claim Term	Petitioner's Proposed Construction	Patent Owner's Proposed Construction
responsive to . . . a presence of an operator's body capacitance to ground  (Claims 37, 40, 61, 83, and 94)	responsive to an increase in capacitance caused by the operator's body	No construction necessary. Plain and ordinary meaning.
input touch terminals  (Claims 37, 40, 45, 61, 66, 83, 94, and 96)	a plurality of distinct touch pads of permanent and fixed location configured to allow detection of an operator's input only by a detector circuit or circuits	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary:

	uniquely associated with the touch pad being touched	“terminal(s) used to accept touch input.” <sup>1</sup>
keypad (Claims 37, 40, 45, 61, 66, 83, 94, and 96)	a multiplicity of fixed, physically distinct, small sized touch pads in a physically close array, such as a keyboard	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary for “small sized input touch terminals of the keypad”: “touch circuits of the input touch terminal(s).”
detector circuit (Claims 37, 39, 40, 47, 48, 61, 62, 63, 83, 84, and 94)	an electronic circuit, separate from the microcontroller and the oscillator, that detects an increase in capacitance to ground	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary: “a circuit that provides a control output signal in response to an operator’s presence.” <sup>2</sup>
control output signal (Claims 37, 39, 40, 47, 48, 61, 62, 63, 83,	a signal sent by the detector circuit that operates the device and is only generated when a sufficient increase in capacitance to	No construction necessary. Plain and ordinary meaning.

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<sup>1</sup> According to Patent Owner, this is the plain and ordinary meaning of “input touch terminals.” (Ex. 1014 at 9-10.)

<sup>2</sup> According to Patent Owner, this is the plain and ordinary meaning of “detector circuit.” (Ex. 1014 at 14.)

84, and 94)	ground is present at a touch pad	If the Court determines that a construction is necessary: “an output signal from a detector circuit that affects a device.”
first and second touch terminals  (Claims 37, 83, and 94)	two touch terminals of permanent, fixed, and distinct physical area and location that are touched sequentially—i.e., first, and then second—by the operator	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary: “two touch circuits used to accept input by an operator.”
defining . . . areas [. . . for an operator to provide input by proximity and touch]  (Claims 37, 40, 83, and 94)	No construction necessary. <sup>3</sup>	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary: “area of the first and second input touch terminals in which an operator provides input.”
small sized input touch terminals of the keypad  (Claims 40, 45, 61, 66, 83, 94, and 96)	No construction necessary. The terms “input touch terminals” and “keypad” should be construed independently as discussed	No construction necessary. Plain and ordinary meaning.  If the Court determines that a construction is necessary:

<sup>3</sup> Petitioner had initially proposed a different construction for this term in litigation, but now agrees that no construction is necessary for this term.

	above.	“touch circuits of an input touch terminal.”
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## IX. DETAILED EXPLANATION OF GROUNDS

### A. Ground 1: *Ingraham I*, *Caldwell*, and *Gerpheide* Render Obvious Claims 37-41, 43, 45, 61, 64-67, 69, 83, 85, 86, 88, 90, 91, 94, 96, 97, 99, 101, and 102

#### 1. Claim 37

- a) “A capacitive responsive electronic switching circuit for a controlled device comprising:”

*Ingraham I* discloses this feature. (Ex. 1002 at ¶¶ 41-42.) For example, *Ingraham I* discloses that “[t]he invention is especially adapted for a keyboard made up of a plurality of such *capacity responsive switches*.” (Ex. 1007 at 1:5-9, emphasis added.) The keyboard of capacity responsive switches controls a device such as an electric motor. (*Id.* at 2:32-35, 3:45-47.) (*See also* discussion above in Section VII.D; citations and analysis below for the remaining elements of this claim.)

- b) “an oscillator providing a periodic output signal having a predefined frequency,”

*Ingraham I* and *Caldwell* discloses this feature. (Ex. 1002 at ¶ 43.) As illustrated in Fig. 3, *Ingraham I* discloses a 115V AC power source. (Ex. 1007 at Fig. 3.) One of ordinary skill in the art would have understood that the 115 VAC power source is a 115 V 60 Hz AC power source derived from the power line providing electricity to the unit housing the device. (Ex. 1002 at ¶ 43.) Indeed, the

incorporated disclosure from *Ingraham II* (see Section VII.E) regarding the control circuit<sup>14</sup> shows that the 115 VAC signal is a 60 Hz AC power signal. (See e.g., Ex. 1008 at Fig. 1, 2:10-19.) One of ordinary skill in the art would have also understood that the 115 V 60 Hz AC signal disclosed by *Ingraham I* is a *periodic signal* that oscillates at a *predefined frequency*<sup>4</sup> of 60 Hz. (Ex. 1002 at ¶ 43.)

While *Ingraham I* does not explicitly disclose an oscillator circuit, one of ordinary skill in the art would have understood that an oscillator circuit is necessary to generate the 60 Hz AC signal. (Ex. 1002 at ¶ 44.) (See also Ex. 1001 at 3:44-56, stating that *Ingraham I* discloses an “oscillator” voltage.”) In any event, *Caldwell* discloses an oscillator 30 that provides an oscillating signal (a periodic square wave) having a predefined frequency (e.g., 100 kHz, 200 kHz) to a matrix of touch pads. (See *supra* Section VII.F, discussing Ex. 1009 at Fig. 12, 4:39-46, 6:40-52.) As discussed below, it would have been obvious to one of ordinary skill in the art at the time of the alleged invention of the ’183 patent to modify the system of *Ingraham I*, based on *Caldwell*, to provide an oscillator that generates a periodic signal (e.g., 115V 60 Hz AC signal) for the circuitry of the touch sensing system in *Ingraham I*. (Ex. 1002 at ¶ 45.)

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<sup>4</sup> Patent Owner’s infringement contentions confirm that “all oscillators have a predefined frequency.” (Ex. 1013 at 12.)

One of ordinary skill in the art would have been encouraged to look to the teachings of *Caldwell* to refine the features of *Ingraham I* because both references disclose sensors that detect a user's touching of a touch terminal based on a change in capacitance resulting from the user's touch. (Ex. 1002 at ¶ 46; Ex. 1007 at 1:65-2:2, 3:1-37; Ex. 1009 at 7:39-42, 7:56-65.) In particular, one of ordinary skill in the art would have been motivated to modify *Ingraham I* based on *Caldwell* in order to allow the system of *Ingraham I* to function in a portable system (e.g., a system such as an automobile in which a connection to the building's power supply is unavailable). (Ex. 1002 at ¶ 47.) One of ordinary skill in the art would have recognized that in such a portable system, due to the absence of an AC power source (e.g., a 115 VAC 60 Hz source), an oscillator would be required to generate the AC signal for the touch sensing circuits and input portions 13 of the touch pad assembly 10 in *Ingraham I*. (*Id.*) Such a skilled person would have had the knowledge and capability to implement a dedicated oscillator circuit that could generate the required AC signal at the desired voltage and frequency (e.g., 115 VAC signal for the system of figure 3 in *Ingraham I*) from a DC power supply (e.g., a car battery). (*Id.*) *Ingraham III*<sup>5</sup> confirms not only the need for such a

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<sup>5</sup> *Ingraham III* is disclosed to corroborate that one skilled in the art would have had the knowledge and capability to implement the discussed modification, and is not

solution but also that the skilled artisan would have been able to accomplish such a modification with predictable success. (*Id.* at ¶ 48; Ex. 1010 at 1:32-44; *see supra* Section VII.E.) *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421 (2007). Additionally, the above discussed modification would have constituted a mere combination of known prior art elements according to known methods that yields predictable results. *See KSR*, 550 U.S. at 415-21. For instance, as noted above, *Ingraham I* and *Caldwell* disclose providing an oscillating signal to input portions and touch sensing circuits. (*See supra* Sections VII.D, VII.F; Ex. 1009 at 6:41-43, 4:39-50.) Moreover, in the combined system, the AC signal and touch sensing circuitry of *Ingraham I*, and the oscillator of *Caldwell* would retain their functionality. (Ex. 1002 at ¶ 49.) And as discussed above, the combination also would have yielded a predictable result in which the oscillator AC signal is provided to the touch sensing circuits and input portions of *Ingraham I*. (*Id.*)

c) “wherein an oscillator voltage is greater than a supply voltage;”

*Ingraham I* in combination with *Caldwell* discloses this feature. (Ex. 1002 at ¶ 50.) As explained above in Section VII.E, *Ingraham I* incorporates by reference disclosure from *Ingraham II* regarding control circuit 14. *Ingraham II*, which discloses the same power supply 70 as *Ingraham I* (*see* comparison in Ex.

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relied upon to disclose any of the features of the challenged claims.

1002 at ¶ 50) discloses that “a 15V power supply 70 is included within circuit 10 for providing power to the logic circuits 80 and 90.” (Ex. 1008 at 3:29-31.) One of ordinary skill in the art would have understood that power supply 70 generates a 15V supply voltage for microcomputer 80 in *Ingraham I*. (Ex. 1002 at ¶ 50.) Therefore, *Ingraham I*, via the incorporated teachings of *Ingraham II*, discloses that an oscillator voltage (115V) is greater than a supply voltage (15V). (*Id.* at ¶ 51) The above disclosures are applicable to the combination of *Ingraham I* and *Caldwell* discussed above for Claim 37(b) (*see* citations and analysis above for Claim 37(b)) because the oscillator, whether considered present in *Ingraham I* or included in *Ingraham I* based on *Caldwell*, continues to generate a 115V AC signal.

- d) “a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively providing signal output frequencies to a closely spaced array of input touch terminals of a keypad”

*Ingraham I* discloses a microcomputer 80 and an array of input portions 13 forming a keyboard system 10. (Ex. 1001 at Figs. 1, 3, 1:5-9, 2:28-35.) As seen in demonstrative A, the keyboard system 10 includes an array of input portions 13. (Ex. 1002 at ¶ 52; *supra* Section VII.D.)

Input portions 13 constitute “input touch terminals” under Petitioner’s proposed construction. (*See* Section VIII.) For instance, it is apparent from figure 3 (*see* demonstrative A, *supra* Section VII.D) that each input portion 13 is

“distinct” because the indicia layer 30 demarcates the boundary between each input portion 13, and each transmission member 28 and plate member 18 for an input portion 13 is spaced apart from corresponding members of another input portion 13. (See Ex. 1007 at Fig. 1, 2:43-45, 2:61-64; Ex. 1002 at ¶ 53.) Moreover, one of ordinary skill in the art would have understood from *Ingraham I*’s disclosure that input portions have a permanent and fixed location on substrate 16. (Ex. 1002 at ¶ 53.) Additionally, *Ingraham I* discloses that each input portion 13 is coupled with a unique touch sensing circuit, which detects whether that input portion has been touched by a user. (See *supra* Section VII.D; see analysis and citations below for Claim 37(f); Ex. 1007 at 3:1-6, 3:30-35.)

Input portions 13 also constitute “input touch terminals” under the plain and ordinary meaning and Patent Owner’s alternative construction of the term because input portions 13 are used to accept a touch input by a user. (See *supra* Section VIII; Ex. 1007 at 3:1-6, 3:30-35; Ex. 1002 at ¶ 54.)

As seen from figure 1 in *Ingraham I* and demonstrative A, input portions 13 form “a closely spaced array of input touch terminals.” (Ex. 1002 at ¶ 55; *supra* Section VII.D.) One of ordinary skill in the art would have also recognized from figure 1 of *Ingraham I* that the input touch portions 13 form a numeric keypad and hence, discloses a “keypad” under the plain and ordinary meaning of the term (see Section VIII), which is further confirmed by *Ingraham I*’s description that the

input portions 13 form “capacitive response switches in a *keyboard* assembly.” (Ex. 1001 at 1:5-9 (emphasis added), 1:50-54; Ex. 1002 at ¶ 55.) Moreover, one of ordinary skill in the art would have understood that because input portions 13 form a “*keyboard* assembly” and are illustrated as a numeric keypad (*see* figure 1), each of the input portions 13 should be the size of a user’s finger. (Ex. 1002 at ¶ 55.) Therefore, one skilled in the art would have understood from the disclosure of *Ingraham I* that input portions 13 are “small sized.” (*Id.*; Ex. 1001 at 6:1-3.) In view of the above, the input portions 13 form a multiplicity of fixed, physically distinct, small sized touch pads in a physically close array, such as a keyboard. Therefore, *Ingraham I* discloses a “keypad” under Petitioner’s construction. (*See supra* Section VIII.)

*Ingraham I* also discloses “keypad” under Patent Owner’s alternative construction. (*See id.*; Ex. 1002 at ¶ 56.) As discussed above and in further detail below with respect to Claim 37(f), each input portion 13 is coupled to a touch sensing circuit and activates the touch sensing circuit upon touching by a user. (Ex. 1002 at ¶ 57; Ex. 1007 at 3:1-6, 3:30-47; *supra* Section VII.D.) Therefore, the input portions 13 are “touch circuits used to accept input by an operator” and form a “keypad” under Patent Owner’s alternative construction. (Ex. 1002 at ¶ 56.) Thus, *Ingraham I* discloses a microcomputer 80 and a closely spaced array of input portions 13 (“input touch terminals”) of a keypad. (*Id.* at ¶ 57.)

*Ingraham I* in combination with *Caldwell* also discloses that the input portions 13 (“closely spaced array of input touch terminals of a keypad”) receive the AC signal from the oscillator (115 VAC source). (*See supra* Section VII.D (annotated Fig. 3, illustrating that the oscillator signal (green line) is provided to each of the input portions 13); *see also* analysis and citations for Claim 37(b).) But *Ingraham I* does not disclose that the oscillator signal is provided to the input portions 13 via the microcontroller. (Ex. 1002 at ¶¶ 58-59.) Therefore, *Ingraham I* does not explicitly disclose “a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively providing signal output frequencies” to the input portions 13, as recited in claim 37(d). (*Id.*) But as explained below, it would have been obvious to implement such features in the system disclosed by *Ingraham I* in light of the disclosures of *Caldwell* and *Gerpheide*.

As discussed above with respect to Claim 37(b), one of ordinary skill in the art would have looked to *Caldwell* for techniques for improving the system of *Ingraham I*. (*See* citations and analysis for Claim 37(b).) Having looked to *Caldwell*, one of ordinary skill in the art would have recognized that *Caldwell* discloses a scanning mechanism for a matrix of touch pads that results in a more compact device in which tens of touch pads can be accessed by a handful of sense and drive electrodes. (Ex. 1002 at ¶¶ 60, 61; *see supra* Section VII.F.) One of

ordinary skill would have recognized that this efficient scanning is possible in *Caldwell* because the oscillator signal is not directly provided to the matrix of touch pads. (Ex. 1009 at Fig. 12.) Instead, a microprocessor 36 controls a demultiplexer 34 to provide the oscillator signal on a strobe line 22 to a row (or column) of touch pads. (*Id.* at 6:40-63; 4:39-50.) Microprocessor 36 then controls a multiplexer 46 and sequentially selects each columns (or rows) of sense electrodes 24 to sense the signal output from the touch pads. (*Id.* at 6:40-63, 8:13-23; *see id.* at Fig. 6; Ex. 1002 at ¶ 60 (showing annotated Fig. 6).) In this manner, all touch pads in the matrix are sequentially scanned. (*Id.* at 8:20-23, Figs. 6, 12.)

It would have been readily apparent to one of ordinary skill that *Caldwell*'s scanning mechanism would have been applicable to *Ingraham I*. (Ex. 1002 at ¶ 61.) For instance, *Ingraham I* discloses a keyboard having four rows and four columns of input portions 13. (*See* demonstrative A in Section VII.D.) Each of the input portions 13 and associated touch sensing circuit receives a periodic signal *directly* from the 115V AC source (“oscillator”) and not *indirectly* like in *Caldwell*. (*See supra* Section IX.A.1(b).) But given *Caldwell*'s disclosure, one of ordinary skill in the art would have been motivated to modify the configuration of *Ingraham I* to incorporate demultiplexer and multiplexer functions (such as the ones disclosed in *Caldwell*) that are controlled by microcomputer 80. (Ex. 1002 at ¶ 64.)

In the resulting combination, rows of input portions 13 would be selected sequentially and the oscillator signal provided to the selected row. (Ex. 1002 at ¶ 64; *see* Ex. 1009 at 6:40-63.) Similar to *Caldwell*, the output signal lines 57 would be multiplexed by a multiplexer controlled by microcomputer 80 to select a column of output signal lines 57. (Ex. 1002 at ¶ 64; Ex. 1009 at 6:40-63.) Like *Caldwell*, the sequential scanning would continue until all input portions 13 of the matrix are scanned. (Ex. 1002 at ¶ 64; Ex. 1009 at 6:40-63, 8:20-23.)

In such a combined system, the microcomputer 80, demultiplexer, and multiplexer collectively perform functions like those associated with the claimed “microcontroller.” (Ex. 1002 at ¶ 64, *see* demonstrative C.) The above combined system would have been configured to include “a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively providing signal output frequenc[y] to a closely spaced array of input touch terminals of a keypad,” as recited in claim 37(d). (Ex. 1002 at ¶ 64.)

The modified system offers several advantages over *Ingraham I*. For instance, in *Ingraham I*, each touch sensing circuit provides an output signal on line 57, which is provided to microcomputer 80 on a dedicated I/O pin. (Ex. 1007 at Fig. 3.) Accordingly, the circuit configuration in *Ingraham I* would have required at least 16 dedicated I/O pins on microcomputer 80, which is undesirable because commercial microprocessors have limited I/O pins and I/O pins also

consume more power. (Ex. 1002 at ¶¶ 62, 63.) Further, *Ingraham I*'s circuit configuration requires 16 wire traces from the AC source to each of the input portions 13 and touch sensing circuits, which is undesirable given that these long wire traces may result in a loss of signal integrity and also cause interference on adjacent wire traces. (*Id.*) The above noted problems would compound if the number of keys on a keyboard is increased, which is something that was desirable at the time of the invention of the '183 patent and is explicitly contemplated by *Ingraham I*. (*Id.*; Ex. 1007 at 2:35-39.)

*Ingraham I* as modified based on *Caldwell* would reduce the number of I/O pins on the microcomputer 80 from 16 to 5 (2 pins for 2 bit address of demultiplexer, 2 pins for 2 bit address of multiplexer, and 1 pin for the input from multiplexer). (Ex. 1002 at ¶ 65, 66.) Moreover, instead of running 16 long wire traces to 16 touch pads from the oscillator, a single wire trace from the AC source to the demultiplexer would have been required with four short wire traces from the demultiplexer to the touch portions 13. (*Id.*; see also *id.* at ¶ 64, demonstrative C.) The savings in the wire traces and number of I/O pins would have been magnified if the number of keys are increased on the keypad. (*Id.*) In view of the above-identified advantages obtained by modifying the configuration of figure 3 in *Ingraham I* based on *Caldwell*, one of ordinary skill would have found the above modification of *Ingraham I* to be a predictable and common sense implementation

as it results in a more compact and resilient device. *See KSR*, 550 U.S. at 415-421. Indeed, the adoption of *Caldwell*'s scanning technique would have been nothing more than the application of a known technique to improve a similar device in the same way given that *Caldwell* and *Ingraham I* disclose similar devices (i.e., capacitive touch response systems). *See id.* (Ex. 1002 at ¶ 67.)

As discussed above with respect to Claim 37(d), the input portions 13 constitute a “closely spaced array of input touch terminals of a keypad.” Moreover, as discussed above, the microcontroller in the combined *Ingraham I-Caldwell* system would use[] the periodic output signal from the oscillator, and selectively provide the oscillator signal frequency (“signal output frequency”) to a closely spaced array of input touch terminals of a keypad, as recited in Claim 37(d). (Ex. 1002 at ¶ 68.) Claim 37(d), however, recites that the microcontroller selectively provides “frequencies” to the input touch terminals as opposed to only providing a single frequency.<sup>6</sup> One of ordinary skill in the art would have found it

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<sup>6</sup> The “frequencies” limitations of this claim, and other claims, were added during reexamination, but are not disclosed or supported by the specification of the '183 patent. (Ex. 1002 at ¶ 69.) While Petitioner cannot raise such issues in this proceeding, Petitioner reserves the right to challenge and address them in other proceedings.

obvious to modify the above *Ingraham I-Caldwell* system based on *Gerpheide* to provide features that adjusts the oscillator signal frequency provided to the input portions 13 to negate the effect of interference on the input portions 13 and touch sensing circuits. (*Id.* at ¶ 69) In such a modified system<sup>7</sup>, the microcontroller would selectively provide *more than one frequency* to the input portions 13 and touch sensing circuits by varying the oscillator signal frequency depending on the sensed interference. (*Id.*)

*Gerpheide* discloses a capacitive touch responsive system that detects the location of a touch. (Ex. 1012 at 1:10-14, 2:61-3:12.) Given that both *Caldwell* and *Ingraham I* also disclose capacitive touch responsive systems that also detect the location of a touch, (*see supra* Sections VII.D, VII.F), one of ordinary skill in the art would have looked to *Gerpheide* to compliment the functionality of the combined *Ingraham I-Caldwell* system. (Ex. 1002 at ¶¶ 70, 71.) *Gerpheide* notes that a “capacitance-based detection device,” such as that described in *Ingraham I*, “may suffer from electrical background interference from its surroundings,” which

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<sup>7</sup> Indeed, during reexamination, Patent Owner acknowledged that *Gerpheide* discloses “selectively providing *frequencies*” and that it would have been obvious to modify a reference, that discloses providing a single frequency, to provide multiple frequencies in view of *Gerpheide*. (Ex. 1006 at 329-30, 331.)

may couple to the touch detection circuitry and interfere with accurate position detection. (Ex. 1012 at 2:37-43.) Accordingly, *Gerpheide* notes that there was a need in the art to provide a touch detection system that rejects electrical interference regardless of its frequency without expensive nulling circuitry. (*Id.* at 2:44-57.) To overcome this problem, *Gerpheide* varies the oscillator signal frequency that is provided to the electrode array (the portions where the user touches). (*Id.* at Figs. 4, 7, 6:5-8, 6:19-26, 8:22-9:33; *see also* Ex. 1006 at 329-30, 333-34.) For instance, the microcontroller 102 evaluates the interference and selects a new reference frequency, which is derived from the oscillator frequency, from a table of frequencies having the lowest interference measurement. (*Id.* at 8:22-9:33, Fig. 7.) This new frequency signal is applied to the electrode array via wires RP or RN. (*Id.* at Fig. 4, 6:19-26; *see also* Ex. 1006 at 65-66, discussing *Gerpheide*.)

In view of the disclosures of *Gerpheide*, *Ingraham I*, and *Caldwell*, one of ordinary skill in the art would have been motivated to incorporate interference negating functionality similar to that described by *Gerpheide* in the above discussed *Ingraham I-Caldwell* system. (Ex. 1002 at ¶ 72.) For instance, one of ordinary skill in the art would have been motivated to provide functionality in the *Ingraham I-Caldwell* system, which selects an oscillator signal frequency from a plurality of frequencies and provides different oscillator signal frequencies at

different times to the input portions 13 based on an interference measurement. (*Id.*) Consequently, in the modified system, the microcontroller would have “selectively provid[ed] signal output frequencies” to the input touch terminals, as required by Claim 37(d). (*Id.*) One skilled in the art would have found such a modification to be a predictable and common sense implementation to allow the combined *Ingraham I-Caldwell* system to reject electrical interference regardless of its frequency without expensive nulling circuitry. (Ex. 1002 at ¶ 72.) *See also KSR*, 550 U.S. at 415-21.

- e) “the input touch terminals comprising first and second input touch terminals, the first and second touch terminals defining areas for an operator to provide an input by proximity and touch”

*Ingraham I* discloses this feature. (Ex. 1002 at ¶¶ 73-76.) As discussed with respect to Claim 37(d), *Ingraham I* discloses an array of input portions 13 (*see* demonstrative A in Section VII.D), which are “input touch terminals.” *Ingraham I* discloses “the first and second touch terminals” under Patent Owner’s construction (plain and ordinary meaning) because as illustrated in figure 1 of *Ingraham I*, the input portions 13 include a first input portion (“first touch terminal”) and a second input portion (“second touch terminal”). Each input portion 13 is also “a touch circuit used to accept input by an operator.” (*See supra* citations and analysis for Claim 37(d); Ex. 1002 at ¶ 73; *supra* Section VII.D.) Therefore, two input portions 13 satisfy Patent Owner’s alternative construction of “first and second

touch terminals,” which is “two touch circuits used to accept input by an operator.”  
(*See* Section VIII.)

The first and second input portions 13 also satisfy Petitioner’s construction of “first and second touch terminals” because as discussed above with respect to Claim 37(d), each input portion 13 is a “permanent, fixed, and distinct physical area and location.” (*See supra* Section VIII.) Moreover, as discussed below with respect to Claim 37(h), the first and second input portions 13 are necessarily configured to be touched sequentially by the operator. (Ex. 1002 at ¶ 74.)

Furthermore, input portions 13 (and therefore, both the first and second input portions 13) define areas for an operator to provide an input by proximity and touch under both parties’ interpretations of the “defining” term. (*See supra* Section VIII.) For instance, each input portion 13 defines a highlighted area (blue in demonstrative A in Section VII.D), which is consistent with the plain and ordinary meaning of the term as proposed by Patent Owner and Petitioner. (Ex. 1002 at ¶ 75) Moreover, the area highlighted in blue above, and others like it, is an area indicated on dielectric member 26 in which an operator provides input. (*Id.*; Ex. 1007 at 2:64-67, 3:1-6, 3:30-36.) Therefore, the first and second input portions 13 satisfy Patent Owner’s alternative construction of “defining areas.”

Moreover, each input portion 13 *defines an area* where the user can provide an input by proximity and touch, as required by Claim 37(e). Specifically,

*Ingraham I* discloses that input portions 13 are “touched” by a user and the resulting change in capacitance to ground for the input portion 13 is detected by the corresponding touch sensing circuit. (Ex. 1007 at 3:1-6, 3:30-36.) But the change in capacitance to ground will also be detected when the user’s finger is “proximal” (but not touching) to the user-facing surface of input portion 13. (Ex. 1002 at ¶ 76.) This is because as the user’s finger comes nearer to the input portion 13, the capacitance to ground, which is inversely proportional to the distance between plate member 18 and the user’s finger, increases. (*Id.*) This increase would be detected by the touch sensing circuit associated with that input portion 13. (*Id.*) The ’183 patent acknowledges this fact-“a major advantage of this methodology [i.e., *Ingraham I*] is that the operator need not come in conductive contact with the touch terminal but rather only in close proximity to it.” (Ex. 1001 at 3:44-59.) Therefore, the input portions 13 define areas “for an operator to provide an input by proximity and touch.” (Ex. 1002 at ¶ 76.)

f) “and a detector circuit coupled to said oscillator for receiving said periodic output signal from said oscillator, and coupled to said first and second touch terminals, said detector circuit being responsive to signals from said oscillator via said microcontroller”

*Ingraham I* discloses a touch sensing circuit, which is a “detector circuit.” (Ex. 1002 at ¶ 77.) The touch sensing circuit satisfies Petitioner’s construction of “detector circuit” (*see supra* Section VIII) because it is an electronic circuit (*see* demonstrative B in Section VII.D illustrating the touch sensing circuit) that detects

an increase in capacitance to ground (*see* citations and analysis below with respect to Claim 37(g); Section VII.D), and as discussed above with respect to claim 37(d), it is separate from the microcontroller and the oscillator. The touch sensing circuit also satisfies Patent Owner’s construction because, as discussed below with respect to Claim 37(g), it is a circuit that provides a control output signal (signal on line 57) in response to an operator’s presence. (Ex. 1002 at ¶ 77, Section VIII.)

*Ingraham I* discloses that each of the input portions 13 (“touch terminals”) is coupled to a touch sensing circuit (“detector circuit”) that detects whether that input portion has been touched by a user. (*See* above analysis for Claim 37(e).) As shown above in demonstrative B (Section VII.D), the touch sensing circuits are coupled to input portions 13 (“first and second touch terminals”). (*See also* citations and analysis below for Claim 37(g); Ex. 1007 at 3:34-39, Fig. 3.) Furthermore, in the combined *Ingraham I-Caldwell* system, the touch sensing circuit (“detector circuit”) receives the oscillator signal via the microcontroller and is therefore “coupled to the oscillator for receiving said periodic output signal from said oscillator, said detector circuit being responsive to signals from said oscillator via said microcontroller.” (*See* above citations and analysis for Claim 37(d), Claim 37(b).) (Ex. 1002 at ¶¶ 78, 79.)

g) “[said detector circuit being responsive to] a presence of an operator's body capacitance to ground coupled to said first and second touch terminals when proximal or touched by the operator to provide a control output signal for

actuation of the controlled device”

*Ingraham I* discloses this feature. (Ex. 1002 at ¶ 80.) Specifically, as discussed with respect to element 37(f) and as discussed in Section VII.D, *Ingraham I* discloses multiple touch sensing circuits (“detector circuit”) associated with corresponding input portions 13 (“first and second touch terminals”). When a user *touches* one of the input portions 13, the “the capacity-to-ground for the corresponding plate member 18 *is increased substantially*, as illustrated by capacitor 42 in FIG. 3,” i.e., an operator’s body capacitance to ground (represented by capacitor 42) is coupled to the input touch portions 13 when an operator touches the first and second touch terminals. (Ex. 1007 at 3:1-6 (emphasis added), Fig. 3.) Moreover, as discussed above with respect to Claim 37(e), there is also a change in capacitance to ground when the user’s finger is “proximal” (but not touching) to the user-facing surface of input portion 13. (*See* citations and analysis for Claim 37(e); Ex. 1002 at ¶ 80.)

The touch sensing circuits detect this increase in the body capacitance to ground to provide an output signal (“control output signal”) on line 57 to microcomputer 80. (*See* Ex. 1007 at 3:24-39; *see also id.* at 1:65-2:2, “circuit means connected with the plate members respond to capacity between the plate members and ground for producing a signal indicative of a change in capacity

between plate members and ground”; Ex. 1002 at ¶ 81.)<sup>8</sup> The output signal on line 57 is utilized by microcomputer 80 to actuate the controlled device. (*Id.* at 3:39-47.) Therefore, *Ingraham I* discloses that the touch sensing circuits provide in response to an operator’s touch “a control output signal for actuation of the controlled device.” (Ex. 1002 at ¶ 82.) Output signal on line 57 satisfies Petitioner’s proposed construction of “control output signal” because it is sent by the touch sensing circuit (“detector circuit”) for actuation of a controlled device when the body capacitance to ground at a touch pad increases substantially. (*See supra* Section VIII; Ex. 1002 at ¶ 82.) The output signal also satisfies Patent Owner’s constructions (plain and ordinary meaning, and alternative construction) because it is an output signal from a detector circuit and it affects a controlled device. (Ex. 1002 at ¶ 82; Section VIII.)

As discussed above, *Ingraham I* discloses that the detector circuit is responsive not only to “a presence of an operator's body capacitance to ground” but more particularly, to an “increase in capacitance caused by the operator’s body,” as set forth under Petitioner’s proposed construction of “responsive to a presence of

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<sup>8</sup> The '183 patent acknowledges that the touch sensing circuits in *Ingraham I* are responsive to the presence of an operator’s body capacitance to ground. (Ex. 1001 at 3:53-59.)

an operator's body capacitance to ground.” (Ex. 1002 at ¶ 83.) Specifically, *Ingraham I* discloses that when a user *touches* one of the input portions 13, the “the capacity-to-ground for the corresponding plate member 18 *is increased substantially*, as illustrated by capacitor 42 in FIG. 3.” (Ex. 1007 at 3:1-6 (emphasis added), Fig. 3.) An increase in the capacitance to ground (i.e., addition of capacitor 42 in Fig. 3) draws a larger current to ground that has to come from the base 52 of transistor 50. (*See supra* Sections VII.A, VII.D; Ex. 1002 at ¶ 83.) One of ordinary skill in the art would have realized from the disclosure of *Ingraham I* that this increase in the current to ground is drawn from the base terminal 52 of transistor 50 and causes “the voltage level on base 52 [to] drop sufficiently to establish a forward-biased base emitter junction for the transistor [50],” which ultimately results in the output of a high signal on line 57 to microcomputer 80. (Ex. 1002 at ¶ 83; Ex. 1007 at 3:24-29.) Therefore, *Ingraham I*'s touch sensing circuit is “responsive to an increase in capacitance caused by the operator's body,” as set forth in Petitioner's construction of the “responsive” feature and also necessarily meets the plain and ordinary meaning of this limitation as required by Patent Owner. (*See supra* Section VIII.)

- h) “said detector circuit being configured to generate said control output signal when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal.”

As discussed with respect to element 37(e), the keyboard of *Ingraham I*

includes a first input portion 13 (“first touch terminal”) and a second input portion 13 (“second touch terminal”). As discussed with respect to element 37(g), the touching sensing circuit (“detector circuit”) generates an output signal (“control output signal”) on line 57 when the operator touches a corresponding input portion 13 (“touch terminal”). Therefore, the touching of the first touch terminal results in a first control output signal and the touching of a second touch terminal *after* touching the first touch terminal results in a second control output signal. The second control output signal is therefore, an output signal generated by the detector circuit “when the operator is proximal or touches said second touch terminal after the operator is proximal or touches said first touch terminal.” Such an operation would necessarily occur in *Ingraham I* when an operator uses the keypad (*see* Ex. 1007, Fig. 1) in *Ingraham I* to perform a multi-input operation, such as inputting two or more different digit pins, which would require the operator to touch a second input portion 13 after touching a first input portion 13. (Ex. 1002 at ¶ 84.) Given the disclosure of *Ingraham I* as discussed above, each touch would necessarily output a signal on line 57. (*Id.*) Thus, the detector circuit of the combined *Ingraham I-Caldwell-Gerpheide* system discloses this claim feature. (*Id.*)

## 2. Claim 38

- a) “The capacitive responsive electronic switching circuit as defined in claim 37, wherein feedback to the operator is provided by an indicator activated by

the microcontroller after the operator touches the second touch terminal.”

The combined *Ingraham I-Caldwell-Gerpheide system* discloses this feature. (Ex. 1002 at ¶ 85.) For example, *Ingraham I* discloses actuation of a controlled device (e.g., electric motor) by microcomputer 80 in response to the operator touching one of input portions 13 (“second touch terminal”). (Ex. 1007 at 2:32-35, 3:34-47.) *Ingraham II*, which is incorporated by reference and further discloses the control circuit 14 in *Ingraham I*, discloses that the controlled device could be a lamp. (Ex. 1008 at 2:23-27.) The actuation of such controlled devices would provide “an indicator.” For instance, the turning ON of a lamp or a motor would provide a physical indicator (e.g., vibration, light, noise) of the activation of the controlled device. Indeed, Patent Owner acknowledges that “[t]he indication can also be physical in form, e.g., vibrations.” (Ex. 1013 at 20.)

### 3. Claim 39

- a) “The capacitive responsive electronic switching circuit as defined in claim 37, wherein said detector circuit compares a sensed body capacitance change caused by the body capacitance decreasing a second touch terminal signal on the detector to ground when proximate to the second touch terminal to a threshold level to generate the control output signal,”

The combined *Ingraham I-Caldwell-Gerpheide system* discloses this feature. (Ex. 1002 at ¶¶ 86-87.) As discussed with respect to Claim 37(g), when a user touches or is proximal to the input portion 13 (“second touch terminal”), the user’s body capacitance to ground 42 couples to the input portion 13. (Ex. 1007 at 3:1-6.)

The coupling of the user's body capacitance to ground 42 decreases the voltage level on base 52, i.e., "decreas[es] a second touch terminal signal" of transistor 50 towards ground. (*Id.* at 3:34-39; Ex. 1002 at ¶ 86.) That is, "the body capacitance decreas[es] a second touch terminal signal on the detector to ground when proximate to the second touch terminal." This decrease in the voltage level of base 52 causes an increase in the voltage difference between the emitter and base ( $V_{EB}$ ) ("sensed body capacitance change"). (Ex. 1007 at 3:34-39; Ex. 1002 at ¶ 87.) When the change in  $V_{EB}$  ("sensed body capacitance change"<sup>9</sup>) exceeds a threshold value sufficient to forward bias transistor 50, transistor 50 turns ON to output a signal ("control output signal") on line 57. (Ex. 1007 at 3:34-39; Ex. 1002 at ¶ 87.) That is, the "detector circuit compares a sensed body capacitance change . . . to a threshold value to generate the control output signal." (Ex. 1002 at ¶ 87.)

b) "and wherein feedback to the operator is provided by an indicator activated by the microcontroller after the operator touches the second touch terminal."

The combined *Ingraham I-Caldwell-Gerpheide system* discloses this feature

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<sup>9</sup> The '183 patent does not utilize the term "sensed body capacitance change" anywhere in the specification. (Ex. 1002 at ¶ 87, n.8.) However, based on the discussion of touch circuit 400 at column 15, lines 29-46, one skilled in the art would understand that the change in the  $V_{EB}$  of transistor 410 is the "sensed body capacitance change." (*Id.*)

for at least the same reasons as discussed above with respect to Claim 38. (*See* above citations and analysis for claim 38; Ex. 1002 at ¶ 88.)

#### 4. Claim 40

a) “40. A capacitive responsive electronic switching circuit comprising:”

To the extent the preamble is limiting, *Ingraham I* discloses these features for at least the same reasons above for Claim 37(a). (*See* above citations and analysis for claim 37(a); Ex. 1002 at ¶ 89; citations and analysis below for the remaining elements of this claim.)

b) “an oscillator providing a periodic output signal having a predefined frequency;”

*Ingraham I* and *Caldwell* discloses these features for at least the same reasons as discussed above for Claim 37(b). (*See* above citations and analysis for claim 37(b); Ex. 1002 at ¶ 90.)

c) “a microcontroller using the periodic output signal from the oscillator, the microcontroller selectively providing signal output frequencies to a plurality of small sized input touch terminals of a keypad,”

The combined *Ingraham I-Caldwell-Gerpheide* system discloses this feature. (*See* above citations and analysis for claim 37(d); Ex. 1002 at ¶ 91.) Furthermore, input portions 13 in *Ingraham I* constitute “small sized input touch terminals of a keypad” under their plain and ordinary meaning, as required under both Patent Owner’s construction (*see supra* Section VIII) because as discussed above with respect to Claim 37(d), input portions 13 are “small sized” and constitute “input

touch terminals.” (See citations and analysis for Claim 37(d).) Finally, the input portions 13 also satisfy the Patent Owner’s alternative construction (see *supra* Section VIII) because as discussed with respect to Claim 37(f), each input portion 13 is coupled to a touch sensing circuit and activates the touch sensing circuit upon touching by a user. (Ex. 1002 at ¶ 91; Ex. 1007 at 3:1-6, 3:30-47.)

- d) “wherein the selectively providing comprises the microcontroller selectively providing a signal output frequency to each row of the plurality of small sized input touch terminals of the keypad”

The *Ingraham I-Caldwell-Gerpheide* system discloses these features for reasons similar as discussed above for claim 37(d) and as further explained below.

(See citations and analysis above with respect to claim 37(d); Ex. 1002 at ¶ 92.)

For instance, the circuitry of the combined system that constitutes a microcontroller receives a periodic output signal from the oscillator and provides the oscillator signal frequency (“signal output frequency”) to each row of input portions 13 by selecting at any given time one of the rows through the demultiplexer. (See citations and analysis above with respect to claim 37(d)(1); see also Ex. 1009 at 6:61-63, 8:13-23.) That is, the microcontroller “selectively” provides the received oscillator signal to each row of the input portions 13 (“plurality of small sized input touch terminals of a keypad”) in the combined system. (Ex. 1002 at ¶ 92.)

- e) “the plurality of small sized input touch terminals defining adjacent areas on a dielectric substrate for an operator to provide inputs by proximity and

touch; and”

As discussed with respect to Claim 37(d) and 40(c), the input portions 13 as described by *Ingraham I* in the combined *Ingraham I-Caldwell-Gerpheide* system constitute a “plurality of small sized input touch terminals.” (*See* analysis and citations for claim 37(d) and 40(c).) Moreover, as discussed above with respect to Claim 37(e), each input portion 13 *defines an area* where the user can provide an input by proximity and touch. (*See* analysis and citations for claim 37(e).) As shown in demonstrative A (section VII.D), adjacent areas are defined on the dielectric member 26 (“dielectric substrate”) by the square boxes in indicia 30, which adheres to the back surface of dielectric member 26, that are visible to the user. (Ex. 1002 at ¶ 93; Ex. 1007 at 2:55-67.) An example of a defined “area” is shown above in blue in demonstrative A in Section VII.D. (Ex. 1002 at ¶ 93.)

- f) “a detector circuit coupled to said oscillator . . . responsive to signals from said oscillator via said microcontroller”
- g) “and a presence of an operator's body capacitance to ground coupled to said touch terminals when proximal or touched by the operator,”

The combined *Ingraham I-Caldwell-Gerpheide* system discloses the features of **Claim 40(f)** and **Claim 40(g)** for at least the same reasons as discussed above

with respect to Claims 37(f) and 37(g), respectively.<sup>10</sup> (*See* citations and analysis above with respect to claims 37(f), 37(g); Ex. 1002 at ¶¶ 94, 95.)

- h) “wherein said predefined frequency of said oscillator and said signal output frequencies are selected decrease a first impedance of said dielectric substrate relative to a second impedance of any contaminate that may create an electrical path on said dielectric substrate between said adjacent areas defined by the plurality of small sized input touch terminals,”<sup>11</sup>

As discussed above with respect to Claim 40(b), *Ingraham I* in combination with *Caldwell* discloses an oscillator providing an oscillator signal having a predefined frequency. (*See* above citations and analysis for claim 40(b); Ex. 1002 at ¶ 96.) Furthermore, as discussed above with respect to Claim 40(c), in the combined *Ingraham I-Caldwell-Gerpheide* system, the microcontroller selectively

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<sup>10</sup> Given that recitations of certain claim elements track those of other claim elements previously addressed, where appropriate, Petitioner groups certain claim elements and refers back to analysis addressed in other portions of the petition using claim element notations, such as, claim 37(f), claim 37(g), etc.

<sup>11</sup> Petitioner reserves the right to challenge in district court the validity of this and other limitations of the challenged claims under 35 U.S.C. § 112, which cannot be raised in this proceeding. By addressing the limitation in this Petition, Petitioner does not agree that the meets and bounds of the limitations would be understood by one of ordinary skill in the art with reasonable certainty.

varies the oscillator signal frequency provided to the input portions 13, which constitutes “selectively providing signal output frequencies,” as recited in Claim 40(c). But the remainder of this claim limitation, i.e., selecting the frequency “to decrease a first impedance of said dielectric substrate relative to a second impedance of any contaminate that may create an electrical path on said dielectric substrate between said adjacent areas defined by the plurality of small sized input touch terminals” is an intended use limitation and should not be given any patentable weight given that claim 40 is an apparatus claim. *See, e.g., Medtronic, Inc. v. Nuvasive, Inc.*, IPR2014-00034, Paper No. 11 at 8-9 (Apr. 8, 2014); *Digital Ally, Inc. v. Utility Associates, Inc.*, IPR2015-00725, Paper No. 7 at 5-6 (Oct. 1, 2014).

To the extent any patentable weight is given to the above limitation, the combined *Ingraham I-Caldwell-Gerpheide* system renders this limitation obvious. As discussed above with respect to Claims 37(b) and 37(d), one of ordinary skill in the art would have been motivated to combine the teachings of *Ingraham I, Caldwell*, and *Gerpheide*. (*See* citations and analysis above for Claims 37(b) and 37(d).) *Caldwell* discloses that the oscillator signal frequency (i.e., the frequency of the strobe signal) is between 100 kHz and 200 kHz, or is greater than 200 kHz. (Ex. 1009 at 4:39-50, 6:41-43.) Both these frequency ranges “decrease a first impedance of said dielectric substrate relative to a second impedance of any

contaminate that may create an electrical path on said dielectric substrate between said adjacent areas defined by the plurality of small sized input touch terminals,” as recited in Claim 40(h).<sup>12</sup> (Ex. 1002 at ¶ 96.)

Furthermore, in light of the disclosures of *Ingraham I*, *Caldwell*, and *Gerpheide*, one of ordinary skill in the art would have been motivated to configure the oscillator of the combined *Ingraham I-Caldwell-Gerpheide* system to provide a frequency between 100 kHz and 200 kHz, or a frequency greater than 200 kHz because such a high frequency range would have provided a low impedance touch sensor. (Ex. 1002 at ¶ 97.) As discussed in *Caldwell*, one of ordinary skill would have recognized the importance of reducing the impedance for the touch pads (input portions 13 in *Ingraham I*) because it helps address issues caused by the

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<sup>12</sup> This understanding is consistent with the limitations reflected in the '183 patent. For instance, claim 43 of the '183 patent, which depends from claim 41, clarifies that the “signal output frequency” provided to the input touch terminals is “greater than 100 kHz.” Thus, a frequency “greater than 100 kHz” must by the claims themselves, “decrease a first impedance of said dielectric substrate relative to a second impedance of any contaminate that may create an electrical path on said dielectric substrate between said adjacent areas defined by the plurality of small sized input touch terminals.”

presence of contaminants (e.g., water) that create an electrical path on the dielectric substrate of the touch system. (Ex. 1009 at 1:39-50.) Indeed, the problem of contaminants creating an electrical path between adjacent touch pads was known to one of ordinary skill in the art. (Ex. 1016<sup>13</sup> at 5:12-23; Ex. 1002 at ¶ 97.) But it was also well understood by one of ordinary skill in the art that a higher frequency of the oscillator signal would reduce the impedance of the touch pads and alleviate the effect of cross-coupling between adjacent touch pads caused by the contaminants. (Ex. 1002 at ¶ 97; *see also* Ex. 1016 at 5:12-23.) Accordingly, one of ordinary skill in the art would have appreciated that the frequency of the oscillator signal is a “result-effective variable” that affects the impedance of the input portions 13 in *Ingraham I* and therefore, it would have been obvious to one of ordinary skill in the art to find the optimum range for the oscillator signal frequency through routine experimentation. *In re Boesch*, 617 F.2d 272, 276 (CCPA1980) (stating that “discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art.”); *In re Luck*, 476 F.2d 650, 652-53 (CCPA 1973). Accordingly, it would have been obvious to

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<sup>13</sup> Ex. 1016 is disclosed to corroborate that one skilled in the art would have had the knowledge and capability to implement the discussed modification, and is not relied upon to disclose any of the features of the challenged claims.

one of ordinary skill to optimize and select an oscillator frequency to “decrease a first impedance of said dielectric substrate relative to a second impedance of any contaminate that may create an electrical path . . . ,” as recited in Claim 40. (Ex. 1002 at ¶ 97.)

Furthermore, one of ordinary skill in the art would have found it obvious to substitute the 60 Hz oscillator signal frequency disclosed in *Ingraham I* with higher oscillator frequency values (e.g., greater than 100 kHz or 200 kHz) because such a modification would have been a simple substitution of one known element for another to obtain predictable results. *See KSR*, 550 U.S. at 415-21. Indeed, *Ingraham I* and *Caldwell* each discloses providing oscillating signals at certain frequencies to input portions and touch sensing circuits. (*See supra* Section IX.A.1(b) (60 Hz); Ex. 1009 at 6:41-43, 4:39-50 (100 KHz or 200 KHz).) Given that substituting the oscillator signal frequency of 60 Hz in *Ingraham I* with higher frequency values (e.g., a frequency greater than 100 kHz or 200 kHz as disclosed in *Caldwell*) was within the level and knowledge of one of ordinary skill in the art, it would have been simple and straightforward for one of ordinary skill in the art to configure the combined system of *Ingraham I-Caldwell* to function with an oscillator frequency with higher frequency values such as those greater than 100 kHz. (Ex. 1002 at ¶ 98.) Moreover, the combination would have yielded a predictable result in which the oscillator AC signal is provided to the touch sensing

circuits and input portions of *Ingraham I* with the higher frequency signal. (*Id.*)

As discussed above, based on dependent claim 43, the combined system having a frequency of greater than 100 kHz or 200 kHz satisfies the features recited in Claim 40(h). (Ex. 1002 at ¶ 98.)

- i) “and wherein said detector circuit compares a sensed body capacitance change to ground proximate an input touch terminal to a threshold level to prevent inadvertent generation of the control output signal.”

The '183 patent does not describe what is meant by the term “sensed body capacitance change to ground proximate the input touch terminal,” or use this term at all. (Ex. 1002 at ¶ 99.) But dependent claim 47 clarifies that the “sensed body capacitance change to ground proximate the input touch terminal *is caused by* the operator’s body capacitance decreasing an input touch terminal signal at the detector” (emphasis added). As discussed above with respect to Claim 39(a), when a user touches or is proximal to the input portion 13, the user’s body capacitance to ground 42 *decreases* the voltage level on base 52 of transistor 50, which translates into an increase in the voltage difference between the emitter and base ( $V_{EB}$ ). (*See* citations and analysis for Claim 39(a); Ex. 1007 at 3:34-39; Ex. 1002 at ¶ 100.) Therefore, the change in  $V_{EB}$  is a “sensed body capacitance change proximate an input touch terminal<sup>14</sup>” because it is caused by “the operator’s body capacitance

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<sup>14</sup> *See* note 9, *supra*.

decreasing an input touch terminal signal at the detector.” Moreover, as discussed with respect to Claim 39(a), this change in  $V_{EB}$  is compared to a threshold value to generate a signal (“control output signal”) on line 57. (Ex. 1007 at 3:34-39; Ex. 1002 at ¶ 100.) Accordingly, *Ingraham I* discloses that “said detector circuit compares a sensed body capacitance change to ground proximate an input touch terminal to a threshold level to . . . [generate] the control output signal,” as recited in Claim 40(i). (Ex. 1002 at ¶ 100.)

That the claimed “compare” features in the claim is recited “to prevent inadvertent generation of the control output signal” should be given no patentable weight. Claim 40 is an apparatus claim, and these limitations constitute an intended use of the structure recited in the claim. *See, e.g., Medtronic, Inc.*, Paper No. 11 at 8-9; *Digital Ally, Inc.*, Paper No. 7 at 5-6. However, even if such features were given patentable weight, such features are necessarily disclosed by *Ingraham I* and would have been obvious to implement in the combined *Ingraham I-Caldwell-Gerpheide* system. For example, *Ingraham I* discloses prevent an inadvertent generation of the control output signal because it requires the  $V_{EB}$  of transistor 50 to cross a threshold value, which in turn requires an operator to actually touch or bring their finger sufficiently close to the input portion 13 to cause a proper touch to be sensed. (Ex. 1002 at ¶ 101.) To the extent such features are not inherently disclosed, one of ordinary skill in the art would have found it

obvious to configure the circuitry used in the combined *Ingraham I-Caldwell-Gerpheide* system as discussed above to take into account inadvertent touch detections, including any caused by contaminants, position of a user's finger, etc., by using threshold values that refine the sensitivity of the touch detections for particular applications and environments. (*Id.*) Such implementations would have been within the realm of knowledge and capability of such a skilled person, and given the disclosure of *Ingraham I*, *Caldwell*, and *Gerpheide*, one of ordinary skill in the art would have been motivated to provide them in the combined system as discussed above for this claim. (*Id.*)

#### 5. Claim 61

- a) “A capacitive responsive electronic switching circuit comprising:”
- b) “an oscillator providing a periodic output signal having a predefined frequency;”

*Ingraham I* discloses the features of **Claim 61(a)** and, *Ingraham I* in combination with *Caldwell* discloses the features of **Claim 61(b)** for at least the same reasons as discussed above with respect to Claims 37(a) and 37(b), respectively. (*See* above citations and analysis for claims 37(a), 37(b); Ex. 1002 at ¶¶ 102, 103; citations and analysis below for the remaining elements of this claim.)

- c) “a microcontroller using . . . of the keypad,” (Ex. 1001 at p. 39, 3:40-47)

The combined *Ingraham I-Caldwell-Gerpheide* system discloses this feature for at least the same reasons as discussed above with respect to Claims 40(c) and

40(d). (*See* above citations and analysis for claims 40c and 40(d); Ex. 1002 at ¶ 104.)

d) “and wherein a peak . . . a supply voltage;” (Ex. 1001 at p. 39, 3:47-48)

As discussed with respect to Claim 37(d), in the combined *Ingraham I-Caldwell-Gerpheide* system, the microcontroller selectively provides “signal output frequencies” because it varies the oscillator signal frequency. In *Ingraham I*, the oscillator signal peak voltage is 115 V because the oscillator produces a 115 VAC signal, which is greater than a supply voltage of 15V. (*See* citations and analysis for Claim 37(c); Ex. 1002 at ¶ 105.) Therefore, the peak voltage of the signal out frequencies (oscillator signal frequencies) is greater than a supply voltage.

e) “the plurality of small sized input touch terminals . . . proximity and touch; and” (Ex. 1001 at p. 39, 3:49-51)

f) “a detector circuit . . . responsive to signals from said oscillator via said microcontroller ” (Ex. 1001 at p. 39, 3:52-56)

g) “[said detector circuit being responsive to] a presence of . . . control output signal,” (Ex. 1001 at p. 39, 3:56-59)

h) “wherein said predefined . . . touch terminals,” (Ex. 1001 at p. 39, 3:60-66)

i) “and wherein . . . control output signal.” (Ex. 1001 at p. 39, 3:66-4:3)

The combined *Ingraham I-Caldwell-Gerpheide* system discloses the features of **Claim 61(e)** for at least the same reasons as discussed above with respect to Claim 40(e), the features of **Claim 61(f)** for at least the same reasons discussed

above for Claim 37(f), the features of **Claim 61(g)** for at least the same reasons discussed above for Claim 37(g), the features of **Claim 61(h)** for at least the same reasons discussed above for Claim 40(h), and the features of **Claim 61(i)** for at least the same reasons discussed above for Claim 40(i). (*See* above citations and analysis for claims 40(e), 37(f), 37(g), 40(h), 40(i); Ex. 1002 at ¶¶ 106-10.)

## 6. Claim 83

- a) “A capacitive responsive electronic switching circuit for a controlled keypad device comprising:”

*Ingraham I* disclose this feature for at least the same reasons as discussed above for Claim 37(a). (*See* above citations and analysis for claim 37(a); Ex. 1002 at ¶ 111; citations and analysis below for the remaining elements of this claim.)

*Ingraham I* discloses a “controlled keypad device” because as discussed with respect to Claim 37(d), *Ingraham I* discloses a “keypad” formed from a plurality of input portions 13 and, as discussed with respect to Claim 37(g), touching of these input portions 13 controls actuation of the “controlled device.” (*Id*; *see also* above citations and analysis for claims 37(d) and 37(g).)

- b) “an oscillator . . . a predefined frequency;” (Ex. 1001 at p. 40, 5:45-46)

*Ingraham I* and *Caldwell* disclose this feature for at least the same reasons as discussed above for Claim 37(b). (*See* above citations and analysis for claim 37(b); Ex. 1002 at ¶ 112.)

- c) “a microcontroller using . . . touch terminals,” (Ex. 1001 at p. 40, 5:47-51)

- d) “wherein a peak . . . a supply voltage;” (Ex. 1001 at p. 40, 5:52-53)
- e) “the first . . . proximity and touch; and” (Ex. 1001 at p. 40, 5:54-56)
- f) “a detector circuit. . . via said microcontroller” (Ex. 1001 at p. 40, 5:57-61)
- g) “[said detector circuit being responsive to] a presence . . . controlled keypad device,” (Ex. 1001 at p. 40, 5:61-65)
- h) “said detector circuit . . . said first touch terminal.” (Ex. 1001 at p. 40, 5:65-6:2)

The combined *Ingraham I-Caldwell-Gerpheide* system discloses the features of **Claim 83(c)** for at least the same reasons as discussed above with respect to Claims 37(d) and 37(e), the features of **Claim 83(d)** for at least the same reasons discussed above for Claim 61(d), the features of **Claim 83(e)** for at least the same reasons discussed above for Claim 37(e), the features of **Claim 83(f)** for at least the same reasons discussed above for Claim 37(f), the features of **Claim 83(g)** for at least the same reasons discussed above for Claims 37(g) and 83(a), and the features of **Claim 83(h)** for at least the same reasons discussed above for Claim 37(h). (*See* above citations and analysis for claims 37(d), 37(e), 37(f), 37(g), 37(h), 83(a); Ex. 1002 at ¶¶ 113-18.)

## 7. **Claim 94**

- a) “A capacitive responsive electronic switching circuit for a controlled keypad device comprising:”

To the extent the preamble is limiting, *Ingraham I* discloses this feature for at least the same reasons discussed above for Claim 83(a). (*See* above citations

and analysis for claim 83(a); Ex. 1002 at ¶ 119; citations and analysis below for the remaining elements of this claim.)

b) “an oscillator . . . a predefined frequency;” (Ex. 1001 at p. 40, 6:41-42)

*Ingraham I* and *Caldwell* disclose this feature for at least the same reasons discussed above for Claim 37(b). (*See* above citations and analysis for claim 37(b); Ex. 1002 at ¶ 120.)

c) “a microcontroller . . . of the keypad,” (Ex. 1001 at p. 40, 6:43-50)

d) “the input touch terminals comprising first and second input touch terminals;”

e) “and wherein a peak voltage of the signal output frequencies is greater than a supply voltage; [and]”

f) “the first and second input touch terminals defining areas for an operator to provide an input by proximity and touch; and”

g) a detector . . . via said microcontroller” (Ex. 1001 at p. 40, 6:57-61)

h) “[said detector circuit being responsive to] a presence of an operator's body capacitance . . . controlled keypad device,” (Ex. 1001 at p. 40, 6:61-65)

i) “said detector . . . first touch terminal.” (Ex. 1001 at p. 40, 6:65-p. 41, 5:2)

The combined *Ingraham I-Caldwell-Gerpheide* system discloses the features of **Claim 94(c)** for at least the same reasons as discussed above with respect to Claims 37(d) and 40(d), the features of **Claim 94(d)** for at least the same reasons discussed above for Claim 37(e), the features of **Claim 94(e)** for at least the same reasons discussed above for Claim 61(d), the features of **Claim 94(f)** for at least the same reasons discussed above for Claim 37(e), the features of **Claim 94(g)** for

at least the same reasons discussed above for Claims 37(f), the features of **Claim 94(h)** for at least the same reasons discussed above for Claim 37(g), and the features of **Claim 94(i)** for at least the same reasons discussed above for Claim 37(h). (*See* above citations and analysis for claims 37(d), 37(e), 37(f), 37(g), 37(h), 40(d), 61(d); Ex. 1002 at ¶¶ 121-27.)

**Claims 41, 67, 86, 97:** As discussed above with respect to Claims 37(d) and Claim 40(h), a signal output frequency (oscillator signal frequency) is selectively provided to each row of the input portions 13. (*See* citations and analysis for Claims 37(d) and 40(h).) Moreover, as discussed above with respect to Claim 37(d), the combined *Ingraham I-Caldwell-Gerpheide* system would include functionality for the oscillator frequency to be selected from a plurality of frequency values depending on the interference measured by the microcontroller. (*See* citations and analysis for Claims 37(d) and 40(h).) Accordingly, the combined *Ingraham I-Caldwell-Gerpheide* system discloses the features recited in Claims 41, 67, 86 and 97. (Ex. 1002 at ¶¶ 128-30.)

**Claims 43, 69, 88, and 99:** As discussed above with respect to Claims 40(h) and 41 one of ordinary skill in the art would have found it obvious to optimize and select frequency values for the oscillator signal to reduce the impedance of the input portions 13. (*See above* citations and analysis for Claims 40(h), 41; Ex. 1002 at ¶ 131.) Having identified the oscillator frequency to be a

“result-effective variable,” one of ordinary skill in the art would have found through routine experimentation that frequencies above 100 kHz result in a certain desired impedance for touch portions 13, and therefore would have selected the oscillator frequency from frequencies greater than 100 kHz. (Ex. 1002 at ¶ 131.) In fact, *Caldwell* discloses that one of ordinary skill in the art would have had to select from a frequency greater than 200 kHz, or a frequency between 100 kHz-200 kHz “depending on the detection circuitry used.” (Ex. 1009 at 4:39-46.) Therefore, the combined *Ingraham I-Caldwell-Gerpheide* system discloses the feature recited in Claims 43, 69, 88, and 99. (Ex. 1002 at ¶ 131.)

**Claims 45, 66, 96:** As discussed above with respect to Claims 37(d) and 40(d), in the *Ingraham I-Caldwell-Gerpheide* system, the same oscillator signal is sequentially provided to each row of the input portions 13 until all input portions 13 have been scanned. (Ex. 1002 at ¶ 132; Ex. 1009 at 6:40-63, 8:20-23; *see also* above citations and analysis for Claims 37(d) and 40(d).) Therefore, the “signal output frequency” (oscillator signal frequency) provided to each row has the same Hertz value, like that recited in these claims. (Ex. 1002 at ¶¶ 132-33.)

**Claims 64, 90, 101:** *Ingraham I* discloses through the incorporated disclosure of *Ingraham II* a power supply 70 that generates a 15V supply voltage for microcomputer 80. (*See* citations and analysis for Claim 37(c).) The power supply 70 is, however, a voltage regulator circuit that generates a DC voltage of

15V from a 115V AC signal. (Ex. 1007 at Fig. 3; Ex. 1008 at 3:29-34, Fig. 1.) One of ordinary skill in the art would have found it obvious to provide a DC voltage of desired value to microcomputer 80 using a DC battery instead of generating the DC voltage using a voltage regulator circuit, such as the one in power supply 70. (Ex. 1002 at ¶ 134.) Such a modification would have been desirable in order to adapt the touch circuit configuration of the combined *Ingraham I-Caldwell-Gerpheide* system for a portable system where a DC battery provides the power supply for the entire circuit configuration. (*Id.*; see citations and analysis for Claim 37(b).) In such a portable system, it would have been a common sense implementation to eliminate extra circuit components by providing the microcomputer 80 supply voltage from the DC battery instead of converting the DC battery voltage into an AC signal, and then reconverting the AC signal to a DC voltage via a voltage regulator circuit. (Ex. 1002 at ¶ 134.) Therefore, one of ordinary skill would have found the above modification to be a predictable and common sense implementation as it results in a more compact device. See *KSR*, 550 U.S. at 415-421.

**Claim 65, 91, 102:** As discussed above, *Ingraham I* discloses a power supply 70. (Ex. 1007, Fig. 3, Ex. 1008, Fig. 1; above citations and analysis for claims 64, 90, 101 and claim 37(c).) *Ingraham II* clarifies that power supply 70 has “a voltage regulator circuit including a 15V zener diode coupled in parallel

with a resistor 74 and capacitor 76.” (Ex. 1008 at 3:29-34.) Therefore, the supply voltage of 15V output by power supply 70 disclosed by *Ingraham I* is “a voltage regulator supply voltage.” (Ex. 1002 at ¶ 135.)

**Claim 85:** As discussed above, the microcontroller “selectively” provides the received oscillator signal frequency (“signal output frequency”) to each row of the input portions 13 in the combined *Ingraham I-Caldwell-Gerpheide* system. (See citations and analysis for Claim 37(d).) Therefore, “signal output frequency” (oscillator signal frequency) provided to each row has the same Hertz value and the “the signal output frequencies have a same Hertz value.” (Ex. 1002 at ¶ 136.)

**B. Ground 2: *Ingraham I, Caldwell, Gerpheide, and Wheeler* Render Obvious Claims 47, 48, 62, 63, and 84**

The combined *Ingraham I-Caldwell-Gerpheide* system discloses the “sensed body capacitance change to ground . . . is caused by the operator's body capacitance decreasing an input touch terminal signal on the detector circuit,” as recited in **claims 47 and 62** for at least the same reasons as discussed above for Claim 39(a) and 40(i). (See above citations and analysis for Claims 39(a), 40(i); Ex. 1002 at ¶¶ 137-38.) While the combined *Ingraham I-Caldwell-Gerpheide* system discloses the limitations of independent claims 40 and 61 (see above citations and analysis for claims 40 and 61), *Ingraham I* does not explicitly disclose comparing the change in  $V_{EB}$  (“sensed body capacitance change to ground”) to a *second threshold value* to generate the control output signal, like that

further recited in claims 47 and 62. (Ex. 1002 at ¶ 139.) However, it would have been obvious to one of ordinary skill in the art to modify the combined system to implement such features in light of the disclosure of *Wheeler*.

*Wheeler* discloses an AC electrical circuit 10 for a two hand industrial machine operator control station having capacitive proximity switches. (Ex. 1015 at 4:40-42.) Given that *Caldwell*, *Gerpheide*, and *Ingraham I* relate to capacitive touch responsive switches in touch systems that provide control output signals (*see supra* Section IX.A.1.d)), and *Wheeler* discloses similar types of capacitive touch responsive switches for also providing control signals, one of ordinary skill in the art would have been motivated to look to *Wheeler* to compliment the functionality of the combined system for providing a touch system in different environments, such as those disclosed by *Wheeler*. (Ex. 1002 at ¶ 140.) *Wheeler* discloses the need for safety requirements for an operator to activate two switches in sequence to initiate operation of an industrial machine to prevent possible injury. (Ex. 1015 at 1:7-18.) *Wheeler* discloses the use of capacitive proximity switches in place of palm button switches to provide more ergonomic operations for an operator. (*Id.* at 1:59-2:5.) Thus *Wheeler* discloses a system where the operator must activate two capacitive proximity switches in sequence within a certain time interval to activate an industrial machine. (*Id.* at 6:10-46.)

One of ordinary skill in the art looking to adapt the combined *Ingraham I*-

*Caldwell-Gerpheide* system for applications similar to *Wheeler*'s would have been motivated to modify the combined system to require actuation of two switches in a sequence to actuate a controlled device, such as a machine disclosed in *Wheeler*, to address safety concerns and/or application requirements. (Ex. 1002 at ¶¶ 141, 142.) Accordingly, in light of *Wheeler*, a skilled artisan would have been motivated to modify the combined system to include logic to prevent the generation of the control output signal on line 57 until two touch sensing circuits corresponding to two input portions 13 are activated in sequence. (*Id.*) In such a modified system, the control output signal on line 57 to microcomputer 80 would only be generated if the  $V_{EB}$  of transistor 50 in each of the *two* touch sensing circuits crosses a threshold value. (*Id.*) Accordingly, the “sensed body capacitance change to ground” ( $V_{EB}$ ) would be compared to a “second threshold level to generate the control output signal” in such a modified system. (*Id.*) Such a skilled person would have found such a modification to be a predictable and common sense implementation to allow the combined *Ingraham I-Caldwell-Gerpheide* system to operate in environments like those disclosed by *Wheeler*. (*Id.*) See *KSR*, 550 U.S. at 415-421.

The combined *Ingraham I-Caldwell-Gerpheide-Wheeler* system also discloses the limitations of **claims 48 and 63** for at least the same reasons as discussed above for Claims 39(a) and 47. (See above citations and analysis for

claims 39(a) and 47; Ex. 1002 at ¶ 143.) Additionally, one of ordinary skill in the art would have recognized that the decrease in the base terminal voltage of transistor 50 in *Ingraham I* constitutes a decrease in “amplitude” of an input touch terminal signal. (*Id.*)

The combined *Ingraham I-Caldwell-Gerpheide-Wheeler* system also discloses the limitations of **claim 84** for at least the same reasons as discussed above with respect to Claim 47. (*See* above citations and analysis for claim 47; Ex. 1002 at ¶ 144.) For instance, as discussed above with respect to Claim 47, a skilled artisan would have been motivated to modify the combined *Ingraham I-Caldwell-Gerpheide* system to include logic that would prevent the generation of the control output signal on line 57 until two input portions 13 are touched in sequence, based on *Wheeler*. (Ex. 1002 at ¶ 144.)

## **X. CONCLUSION**

For the reasons given above, Petitioner requests institution of IPR for claims 37-41, 43, 45, 47, 48, 61-67, 69, 83-86, 88, 90, 91, 94, 96, 97, 99, 101, and 102 of the '183 patent based on each of the grounds specified in this petition.

Respectfully submitted,

Dated: April 15, 2016

By: /Naveen Modi/  
Naveen Modi (Reg. No. 46,224)

**CERTIFICATE OF SERVICE**

I hereby certify that on April 15, 2016, I caused a true and correct copy of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 5,796,183 and supporting exhibits to be served via express mail on the Patent Owner at the following correspondence address of record as listed on PAIR:

SLATER & MATSIL, L.L.P.

17950 Preston Rd., Suite 1000

Dallas, TX 75252

A courtesy copy was also sent via express mail to the Patent Owner's litigation counsel listed below:

Roderick G. Dorman

Lawrence M. Hadley

Phillip J. Lee

MCKOOL SMITH, P.C.

300 South Grand Avenue, Suite 2900

Los Angeles, CA 90071

By: /Naveen Modi/  
Naveen Modi (Reg. No. 46,224)