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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* GEORGE P. REITSMA, PAULO GUSTAVO RAYMUNDO  
SILVA, SUMANT BAPAT, and RICHARD D. HENDERSON

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Appeal 2019-004709  
Application 15/062,260  
Technology Center 2800

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Before BEVERLY A. FRANKLIN, LINDA M. GAUDETTE, and  
MONTÉ T. SQUIRE, *Administrative Patent Judges*.

SQUIRE, *Administrative Patent Judge*.

DECISION ON APPEAL<sup>1</sup>

Appellant<sup>2</sup> appeals under 35 U.S.C. § 134(a) from the Examiner’s final decision to reject claims 1–5, 7, 9–11, 13, 15–17, and 19.<sup>3</sup> We have jurisdiction under 35 U.S.C. § 6(b).

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<sup>1</sup> This Decision refers to the Specification filed Mar. 7, 2016 (“Spec.”); Final Office Action dated Jan. 17, 2018 (“Final Act.”); Appeal Brief filed Sept. 17, 2018, as amended Jan. 3, 2019 (“Appeal Br.”); Examiner’s Answer dated Mar. 26, 2019 (“Ans.”); and Reply Brief filed May 28, 2019 (“Reply Brief”).

<sup>2</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies Texas Instruments Incorporated as the real party in interest. Appeal Br. 2.

<sup>3</sup> Claims 6, 12, and 18 are canceled. Appeal Br. 13, 15, 17. Claims 8, 14, and 20 are objected to as being dependent upon a rejected base claim, but

We AFFIRM.

### CLAIMED SUBJECT MATTER

The invention relates to apparatus and methods for wideband capacitive sensing using sense (capacitance) signal modulation, which can be adapted for single ended or differential capacitive sensing. Spec. ¶¶ 2, 6, 7; Abstract. Independent claim 1 illustrates the subject matter on appeal and is reproduced below from the Claims Appendix to the Appeal Brief:

1. A circuit suitable for capacitive sensing, comprising:
  - carrier generation circuitry to generate a carrier signal at a carrier frequency;
  - reference circuitry to generate a reference signal;
  - carrier/drive signal path circuitry to drive a carrier/drive signal out through an output node***, the carrier/drive signal useable for capacitive sensing, including:
    - modulation circuitry to modulate the reference signal with the carrier signal to generate the carrier/drive signal at the carrier frequency,
    - integration circuitry to integrate the carrier/drive signal***; and
    - drive circuitry to drive the integrated carrier/drive signal out through the output node; and
    - sense signal path circuitry*** to receive at an input node an up-modulated sense capacitance signal corresponding to measured capacitance from capacitive sensing, wherein the sense capacitance signal is up-modulated to the carrier frequency based on the integrated carrier/drive signal, including:

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according to the Examiner would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Final Act. 13.

***trans-impedance amplifier circuitry with resistive feedback circuitry***, to generate an amplified up-modulated sense capacitance signal, and

demodulation circuitry to demodulate the amplified up-modulated sense capacitance signal based on the carrier signal, generating a demodulated sense capacitance signal.

Appeal Br. 12 (key disputed claim language italicized and bolded).

### REFERENCES

The Examiner relies on the following prior art references as evidence in rejecting the claims on appeal:

<b>Name</b>	<b>Reference</b>	<b>Date</b>
Basile	US 4,646,295	Feb. 24, 1987
Heinks et al. ("Heinks")	US 7,479,910 B1	Jan. 20, 2009
Brasseur et al. ("Brasseur")	US 2009/0243633 A1	Oct. 1, 2009
Wuerstlein et al. ("Wuerstlein")	US 2014/0002116 A1	Jan. 2, 2014
Caldwell et al. ("Caldwell")	US 2015/0109157 A1	Apr. 23, 2015
Sun et al. ("Sun")	US 2015/0256361 A1	Sept. 10, 2015

### REJECTIONS

On appeal, the Examiner maintains (Ans. 3) the following rejections:

1. Claims 1, 5, 7, 9–11, 13, 15, 17, and 19 are rejected under 35 U.S.C. § 103 as being unpatentable over Brasseur in view of Wuerstlein ("Rejection 1"). Ans. 3; Final Act. 2.

2. Claims 2, 3, and 16 are rejected under 35 U.S.C. § 103 as being unpatentable over Brasseur in view of Wuerstlein,<sup>4</sup> Sun, Basile, and Heinks (“Rejection 2”). Final Act. 10.

3. Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Brasseur in view of Wuerstlein and Caldwell (“Rejection 3”). Final Act. 12.

### OPINION

Having considered the respective positions the Examiner and Appellant advance in light of this appeal record, we affirm the Examiner’s rejections based on the fact-finding and reasoning set forth in the Answer and Final Office Action, which we adopt as our own. We add the following primarily for emphasis.

#### *Rejection 1*

The Examiner rejects claims 1, 5, 7, 9–11, 13, 15, 17, and 19 under § 103 as obvious over the combination of Brasseur and Wuerstlein. In response to the Examiner’s rejection, Appellant presents argument for the patentability of independent claims 1, 9, and 15 as a group but does not present separate argument for the patentability of any dependent claims. Appeal Br. 8, 11. We select claim 1 as representative and claims 5, 7, 9–11, 13, 15, 17, and 19 stand or fall with claim 1. 37 C.F.R. § 41.37(c)(1)(iv).

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<sup>4</sup> Because claims 2–4 and 16 depend from independent claims rejected over the combination of Brasseur and Wuerstlein, the rejections of claims 2–4 and 6 also must be based on this combination. We view the Examiner’s omission of Wuerstlein from the stated rejections of claims 2–4 and 16 as harmless error. *See* Ans. 3 (noting that Appellant’s arguments are directed to the combination of Brasseur and Wuerstlein).

The Examiner determines that the combination of Brasseur and Wuerstlein suggests a circuit satisfying the limitations of claim 1 and concludes the combination would have rendered the claim obvious.

Ans. 4–5 (citing Brasseur, Figs. 3, 8, ¶ 43; Wuerstlein, Fig. 4).

Appellant argues the Examiner’s rejection of claim 1 should be reversed because the cited art does not teach or suggest “carrier/drive signal path circuitry” and “sense signal path circuitry,” as recited in the claim. Appeal Br. 8. In particular, Appellant contends that, in contrast to the claimed invention, which requires that the carrier/drive signal path include “integration circuitry to integrate the carrier/drive signal,” Brasseur teaches only integration of the sensed (measured) signals. *Id.* at 10; *see also* Reply Br. 5 (arguing “Brasseur only teaches integrating ‘measurement values’ (within correlation receiver 216).” Appellant further contends that, unlike Brasseur and Wuerstlein, which both teach driving the sense capacitor by a carrier directly, in the claimed invention

the external sense capacitor is driven by an integrated version of the carrier (integrator 433 in Figure 4), and the sense signal received in the sense signal path is input to trans-impedance amplifier circuitry with resistive feedback circuitry.

*Id.* at 8; *see also* Reply Br. 3–4 (same).

Appellant further argues Brasseur does not teach or suggest sense signal path circuitry including “trans-impedance amplifier circuitry with resistive feedback circuitry,” as claimed. Reply Br. 6. Appellant also argues that neither Brasseur nor Wuerstlein provides any reason to modify Brasseur to include in the sensed signal path “trans-impedance amplifier circuitry with resistive feedback circuitry,” as required by the claim. Appeal Br. 10–11. In particular, Appellant contends

Brasseur/Wuerstlein provide no teaching to modify Brasseur (really, redesign/reconstruct) to include in the sense signal path the claimed “trans-impedance amplifier circuitry with resistive feedback circuitry” for the express reason that Brasseur fails to teach or suggest including in the carrier/drive signal path “integration circuitry to integrate the carrier/drive signal[.]”

*Id.* at 10–11; *see also* Reply Br. 6 (arguing “Wuerstlein provides no teaching to modify Brasseur”).

We do not find Appellant’s arguments persuasive of reversible error in the Examiner’s rejection in view of the fact-finding and reasons the Examiner provides at pages 3–5 and 7–9 of the Answer and pages 4–6 of the Final Office Action, which a preponderance of the evidence supports.

As the Examiner finds (Ans. 4), Brasseur teaches a circuit suitable for capacitance sensing (circuit 300) comprising, among other components, carrier/drive signal path circuitry (signal path circuitry comprising components 206, 207, 208, 209, 212, 102-N, 220) to drive a carrier/drive signal out through an output node (node 102-N), including integration circuitry to integrate the carrier/drive signal. Brasseur, Fig. 3, ¶ 43 (disclosing that “for each electrode **102-n** ( $n=1, \dots, N$ ) a distinct integrator may be used”).

As the Examiner further finds (Ans. 4), Brasseur teaches sense signal path circuitry (signal path circuitry comprising components 220, 112-N, 304, 214) to receive at an input node (receiver 304) an up-modulated sense capacitance signal corresponding to measured capacitance from capacitive sensing, including amplifier circuitry (amplifier 904) to generate an amplified up-modulated sense capacitance signal. Brasseur, Figs. 3, 8, ¶ 48 (“Before the IQ demodulator **214**, the receive signal **116**, **117** is filtered and

amplified by means of a band pass filter **902**, an amplifier **904** and a band pass filter **902** downstream to the amplifier.”), ¶ 51, ¶ 52.

As the Examiner also finds (Ans. 4), regarding the “trans-impedance amplifier circuitry with resistive feedback circuitry” recitation of claim 1, Wuerstlein discloses amplifier circuitry, which teaches that element of the claim. Wuerstlein, Abstract, Fig. 4, ¶ 15, ¶ 44 (“[T]he transimpedance amplifier **20** is formed by an operational amplifier **21** and a coupling capacitance **22**.”), ¶ 46 (disclosing “that a coupling resistor **40** is connected in parallel with the coupling capacitance **22**”).

The Examiner also provides a reasonable basis to evince why one of ordinary skill in the art would have combined the teachings of Brasseur and Wuerstlein to arrive at the claimed invention. *See* Ans. 5. As the Examiner determines (Ans. 5), it would have been obvious to one of ordinary skill in the art at the time of the invention to replace Brasseur’s operational amplifier 904 with Wuerstlein’s trans-impedance amplifier circuitry 20, 21, 22, 40 in order to obtain an amplifier which “has means for compensating for a frequency response” as taught by Wuerstlein. Wuerstlein ¶ 15 (“The evaluation circuit has a transimpedance amplifier, the transimpedance amplifier has means for compensating for a frequency response.”). *See also KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 420 (2007) (explaining that any need or problem known in the art can provide a reason for combining the elements in the manner claimed).

Appellant’s arguments do not reveal reversible error in the Examiner’s factual findings and analysis in this regard.

Appellant’s contentions that “Brasseur teaches only integration of the sensed (measured) signals” (Appeal Br. 10) and “Brasseur only teaches

integrating ‘measurement values’” (Reply Br. 5) are not persuasive because, as the Examiner finds (Ans. 8), Appellant misinterprets and too narrowly construes the scope of Brasseur’s disclosure. Brasseur’s teachings are not limited to the disclosures in its preferred embodiments. *See In re Susi*, 440 F.2d 442, 445–46 (CCPA 1971) (explaining that disclosure of particular preferred embodiments does not teach away from a prior art reference’s broader disclosure); *see also In re Applied Materials, Inc.*, 692 F.3d 1289, 1298 (Fed. Cir. 2012) (“A reference must be considered for everything that it teaches, not simply the described invention or a preferred embodiment.”).

Rather, as the Examiner finds (Ans. 8), Brasseur teaches that electrodes 102-*n* may each have “a distinct integrator” (Brasseur ¶ 43) and the electrodes 102-*n* are the output nodes that the carrier/drive signal passes through via Brasseur’s carrier/drive signal path circuitry before the signal reaches capacitive sensing component 220 (“C<sub>mess</sub>”) (*see* Brasseur, Fig. 3 (depicting signal path circuitry comprising elements 206, 207, 208, 209, 212, 102-N, 220)). Thus, we agree with the Examiner that, based on Brasseur’s disclosure that the nodes 102-*n* may each contain integrators and its depiction of the circuit in Figure 3, one of ordinary skill in the art would have reasonably understood that Brasseur’s device includes “integration circuitry to integrate the carrier/drive signal,” as claimed, and that Brasseur’s circuitry is not necessarily limited to integration circuitry to integrate only sensed/measured signals, as Appellant argues. The fact that Brasseur may describe specific embodiments that “include[] an integrator which integrates a certain number of measurement values” (Brasseur ¶ 42) and “the assignment of measurement values to the integrators may be performed” (*id.* ¶ 43), without more, does not negate or take away from Brasseur’s broad

disclosure that each electrode 102-*n* may use a distinct integrator and suggestion that the integrators integrate the carrier/signal in the manner claimed. *See In re Preda*, 401 F.2d 825, 826 (CCPA 1968) (explaining that a prior art reference’s disclosure must be considered for all that it teaches, including “the inferences which one skilled in the art would reasonably be expected to draw therefrom”).

Appellant’s argument that Brasseur does not teach or suggest sense signal path circuitry including “trans-impedance amplifier circuitry with resistive feedback circuitry” (Reply Br. 6) is not persuasive because it is premised on what Appellant contends the Brasseur reference teaches individually, and not the combined teachings of the cited prior art references as a whole, and what the combined teachings of the references would have suggested to one of ordinary skill in the art. One cannot show non-obviousness by attacking references individually where the rejection is based on a combination of references. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981). The Examiner does not rely solely upon Brasseur for teaching the “trans-impedance amplifier circuitry with resistive feedback circuitry” element of the claim.

Rather, the Examiner relies principally upon Wuerstlein for teaching that claim element. In particular, as the Examiner finds (Ans. 5, 9), Wuerstlein teaches trans-impedance amplifier circuitry with resistive feedback circuitry and that trans-impedance amplifiers are useful as amplifiers with built-in means for compensating for frequency response, and that signal amplification is independently useful in order to aid in signal detection. Wuerstlein, Abstract, Fig. 4 (items 21, 40), ¶ 15.

Appellant's contentions that "Brasseur/Wuerstlein provide no teaching to modify Brasseur" (Appeal Br. 10–11) and "Wuerstlein provides no teaching to modify Brasseur" (Reply Br. 6) are not persuasive because, as previously discussed above, the Examiner does provide a reasonable basis, which a preponderance of the evidence in the record supports, to evince why one of ordinary skill in the art would have combined the teachings of Brasseur and Wuerstlein to arrive at the claimed invention. *See* Ans. 5, 9. Appellant's disagreement as to the Examiner's factual findings and reasons for combining the references, without more, is insufficient to establish reversible error. *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1320 (Fed. Cir. 2006) ("[M]ere statements of disagreement . . . as to the existence of factual disputes do not amount to a developed argument.").

Accordingly, we affirm the Examiner's rejection of claims 1, 5, 7, 9–11, 13, 15, 17, and 19 under 35 U.S.C. § 103 as obvious over the combination of Brasseur and Wuerstlein.

### *Rejections 2 and 3*

In response to the Examiner's rejection of claims 2, 3, and 16 under § 103 as obvious over the combination of Brasseur, Sun, Basile, and Heinks (Final Act. 10–12) and the Examiner's rejection of claim 4 under § 103 as obvious over the combination of Brasseur and Caldwell (Final Act. 12–13), Appellant does not present any new or additional substantive arguments. Rather, Appellant relies on the same arguments previously discussed and presented above in response to the Examiner's rejection of claim 1. *See* Appeal Br. 8, 11; Reply Br. 2.

Thus, based on the fact-finding and reasoning the Examiner provides, and for principally the same reasons we discuss above for affirming the

Examiner's Rejection 1, we affirm the Examiner's rejection of claims 2, 3, and 16 under 35 U.S.C. § 103 as obvious over the combination of Brasseur, Sun, Basile, and Heinks (Rejection 2) and the Examiner's rejection of claim 4 under 35 U.S.C. § 103 as obvious over the combination of Brasseur and Caldwell (Rejection 3).

### CONCLUSION

In summary:

<b>Claim(s) Rejected</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/Basis</b>	<b>Affirmed</b>	<b>Reversed</b>
1, 5, 7, 9–11, 13, 15, 17, 19	103	Brasseur, Wuerstlein	1, 5, 7, 9–11, 13, 15, 17, 19	
2, 3, 16	103	Brasseur, Wuerstlein, Sun, Basile, Heinks	2, 3, 16	
4	103	Brasseur, Wuerstlein, Caldwell	4	
<b>Overall Outcome</b>			1–5, 7, 9–11, 13, 15–17, 19	

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

AFFIRMED