

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SIEMENS MOBILITY, INC., GROUND TRANSPORTATION SYSTEMS USA,
INC., HUMATICS CORP., and PIPER NETWORKS, INC.

Petitioners,

v.

METROM RAIL, LLC
Patent Owner.

Case No. IPR2023-00439
Patent No. 10,179,595

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.1 *et seq.***

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d.	[1C] an attachment structure for attaching the personal alert device to the worker or an item used by the worker;	13

e.	[1D] a power supply for powering components of the personal alert device;	13
f.	[1E] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;.....	14
g.	[1F] one or more indicator components, for outputting alert indications; and	15
h.	[1G] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the personal alert device;	15
i.	[1H1] wherein the personal alert device is operable to: process signals received from a companion alert device, wherein the companion alert device is deployed locally in proximity of the personal alert device and/or within vehicles operating in areas service by workers;	16
j.	[1H2] generate, in response to signals received from the companion alert device, a safety alert; and.....	17
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TABLE OF AUTHORITIES

CASES

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<i>Vivid Techs. v. Am. Sci. & Eng’g,</i> 200 F3d 795 (Fed. Cir. 1999)	9

STATUTES

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APPENDIX LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 10,179,595 (“’595 patent”)
1002	Prosecution History of U.S. Patent No. 10,179,595
1003	Declaration of Michael S. Braasch, Ph.D.
1004	CV of Michael S. Braasch, Ph.D.
1005	U.S. Provisional Application No. 62/177,683
1006	U.S. Patent Application Pub. No. 2012/0296562A1 (“Carlson”)
1007	WO International Publication No. 2013/056244 (“Cross”)
1008	U.S. Patent Application Pub. No. 2012/0326891A1
1009	U.S. Patent Application Pub. No. 2007/0241888A1 (“Mantovani”)
1010	U.S. Patent Application Pub. No. 2008/0170533A1 (“Cyzs”)
1011	German Patent Application Pub. No. DE102008020700A1 (“Meyer-German”) (Attached as Exhibit A to EX1013)
1012	Certified English-Language Translation of German Patent Application Pub. No. DE102008020700A1 (“Meyer”) (Attached as Exhibit B to EX1013)
1013	Declaration of Harry Gigas
1014	U.S. Patent Application Pub. No. 2009/0243397A1 (“Cook”)
1015	U.S. Patent Application Pub. No. 2013/0256466A1
1016	U.S. Patent No. 5,907,294 (“Welte”)
1017	U.S. Patent Application Pub. No. 2013/0021215A1
1018	U.S. Patent Application Pub. No. 2013/0214990A1
1019	U.S. Patent Application Pub. No. 2004/0155822A1
1020	U.S. Patent Application Pub. No. 2007/0281745A1
1021	U.S. Patent Application Pub. No. 2013/0237273A1
1022	U.S. Patent Application Pub. No. 2010/0039978A1

1023	U.S. Patent Application Pub. No. 2010/0124898A1
1024	U.S. Patent No. 5,283,589
1025	U.S. Patent Application Pub. No. 2012/0182191A1
1026	U.S. Patent Application Pub. No. 2005/0143037A1
1027	U.S. Patent Application Pub. No. 2012/0077537A1
1028	U.S. Patent Application Pub. No. 2006/0199146A1
1029	U.S. Patent No. 7,075,427
1030	U.S. Patent No. 6,597,293
1031	U.S. Patent Application Pub. No. 2011/0084854A1
1032	U.S. Patent No. 6,113,037
1033	U.S. Patent Application Pub. No. 2016/0176422A1
1034	Docket as of January 5, 2023 for <i>Metrom Rail, LLC v. Siemens Mobility, Inc., et al.</i> , 1-22-cv-00049 (D. Del.)
1035	First Amended Complaint, <i>Metrom Rail, LLC v. Siemens Mobility, Inc., et al.</i> , 1-22-cv-00049, Dkt. No. 32 (D. Del. Apr. 26, 2022)
1036	“Broadcast,” The Free Dictionary, https://www.thefreedictionary.com/broadcast
1037	IEEE Std 802.15.4™-2011, IEEE Standard for Local and Metropolitan Area Networks: Part 15.4: Low-Rate Wireless Personal Area Networks
1038	Newton’s Telecom Dictionary (27th ed 2013)
1039	Dictionary of Computer Science, Engineering, and Technology (2001)
1040	Microsoft Computer Dictionary (5th Ed. 2002)
1041	U.S. Patent Application Pub. No. 2014/0173155A1

I. MANDATORY NOTICES

A. Real Party-In-Interest – § 42.8(b)(1)

Petitioners Humatics Corp., Siemens Mobility, Inc., Ground Transportation Systems USA Inc., and Piper Networks, Inc. are the real parties-in-interest. Thales USA, Inc. is also a real party-in-interest.

B. Related Matters – § 42.8(b)(2)

1. United States Patent & Trademark Office

U.S. Patent No. 10,179,595 (“the ’595 patent”) claims the benefit of provisional application No. 62/177,683.

The following U.S. patents and patent applications claim the benefit of the filing date of the ’595 patent: U.S. Patent Application No. 15/623,996, filed June 15, 2017, now U.S. Patent No. 10,336,353; (ii) U.S. Patent Application No. 16/013,596, filed June 20, 2018, now U.S. Patent No. 10,896,589; (iii) U.S. Patent Application No. 16/246,940, filed January 14, 2019, now U.S. Patent No. 10,737,709; (iv) U.S. Patent Application No. 16/460,302, filed July 2, 2019, now U.S. Patent No. 10,926,783; (v) U.S. Patent Application No. 16/910,804, filed June 24, 2020.

2. District Court Matters

The '595 patent is at issue in the following pending case: *Metrom Rail, LLC v. Siemens Mobility, Inc., et al.*, 22-cv-00049-RGA (D. Del.).

C. Counsel and Service Information – § 42.8(b)(3) and (b)(4)

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¹ For purposes of this IPR, the individual petitioner parties have designated Mr. Giunta of Wolf Greenfield as lead counsel. Counsel for each petitioner will coordinate and act through the designated lead counsel. With the exception of Petitioner Humatics Corp., each individual petitioner's designation of Mr. Giunta as lead counsel is not representation of an attorney-client relationship between Mr. Giunta (or Wolf Greenfield) and the individual petitioners.

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Powers of attorney are submitted with this petition. Counsel for Petitioners consent to service of all documents via electronic mail.

Petitioners request *inter partes* review of claims 1-30 of the '595 patent.

II. INTRODUCTION

The '595 patent concerns systems for protecting workers (*e.g.*, railroad workers) from approaching vehicles. EX1001, Abstract. The patent criticizes prior-art systems as “costly, inefficient, and/or ineffective” (*id.*, 1:20-25), but the disclosed system uses conventional electronics (*e.g.*, wireless communication circuits) and conventional techniques (*e.g.*, transmitting alert signals) for alerting workers to dangers.

As **Grounds 1A** demonstrates, Cross (EX1007) discloses a system for protecting workers comprising the same devices disclosed in the '595 patent, *i.e.*, personal alert devices attached to workers that communicate wirelessly with vehicle-mounted and wayside-located alert devices. Cross alone anticipates and/or renders obvious the majority of the challenged claims. **Grounds 1B-1F** demonstrate that the remaining challenged claims recite conventional features of electronic devices and/or well-known features of safety-alert systems that would have been obvious over Cross in view of other prior art.

Ground 2 demonstrates that independent claim 21 and dependent claims 22-25 are also separately anticipated by Carlson (EX1006), a patent application assigned to Patent Owner that published years before the '595 patent's alleged priority date.

III. CERTIFICATION OF STANDING

The '595 patent is available for IPR and Petitioners are not barred or estopped from requesting IPR. 37 C.F.R. § 42.104(a).

IV. UNPATENTABILITY GROUNDS

Petitioners request cancellation of claims 1-30 as follows:

Ground	Reference(s)	Claim(s)	Basis
1A	Cross	1, 7-15, 19-25	102/103
1B	Cross, Mantovani	2-5	103
1C	Cross, Cyzs	6	
1D	Cross, Meyer	16-17, 26	
1E	Cross, Cook	14, 18	
1F	Cross, Meyer, Welte	27-30	
2	Carlson	21-25	102

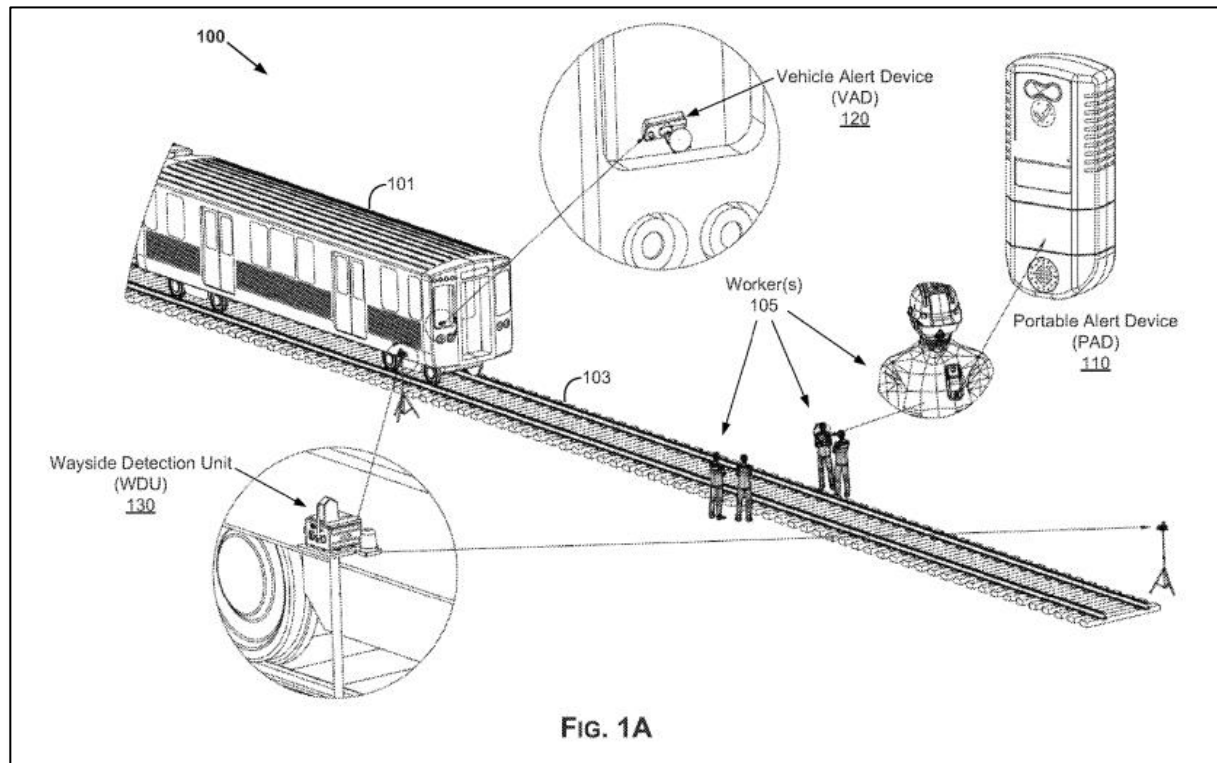
The above-identified references are prior art (at least) under post-AIA § 102(a)(1) based on the following publication dates, each of which is more than one year prior to the earliest-alleged priority date (March 23, 2015):

Reference	Publication
Cross	2013-04-18
Mantovani	2007-10-18
Cyzs	2008-07-17
Meyer	2009-11-05
Cook	2014-10-07
Welte	1996-02-22
Carlson	2012-11-22

Other than Carlson, none of these references was cited during prosecution.

V. THE '595 PATENT²

The '595 patent discloses a system for “worker protection” that “issue[s] alerts” to workers when, for example, a train “is approaching.” 2:28-31. The system utilizes three devices: (1) “vehicle alert devices (VADs)” “mounted on vehicles,” (2) “portable alert device (PADs)” “worn by worker(s),” and (3) “wayside detection units (WDUs)” positioned “near [the vehicle’s] path.” 2:36-64; EX1003 (“Braasch-Decl.”), ¶29. Figure 1A (below) shows the three devices:

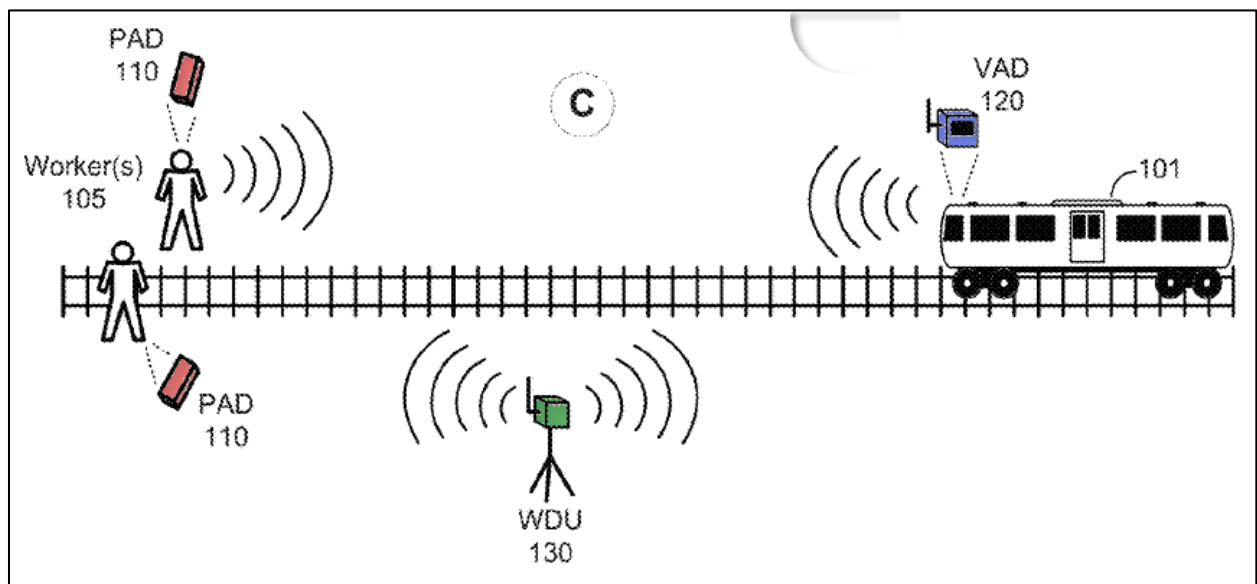


In operation, worker-worn PADs communicate wirelessly with train-mounted VADs and WDUs positioned along the train track. 2:36-51. The train-mounted

² Unless otherwise noted, Section V’s citations are to EX1001.

VADs and track-located WDUs are configured to transmit either alerts to the worker-worn PADs or signals that cause the PADs themselves to trigger alerts. 2:39-42. For example, a train-mounted VAD is configured to “trigger alerts under particular conditions—*e.g.*, when it detects it is approaching a crew equipped with” PADs. 2:43-51. Likewise, a track-located WDU is configured to trigger an alert when, for example, it detects a train approaching a worksite. 2:59-64. When an alert is triggered, the PADs may “issue an indication (*e.g.*, audio, visual, tactile, etc.) to alert the worker wearing it of an approaching object (that pose[s] a safety concern).” 3:3-9.

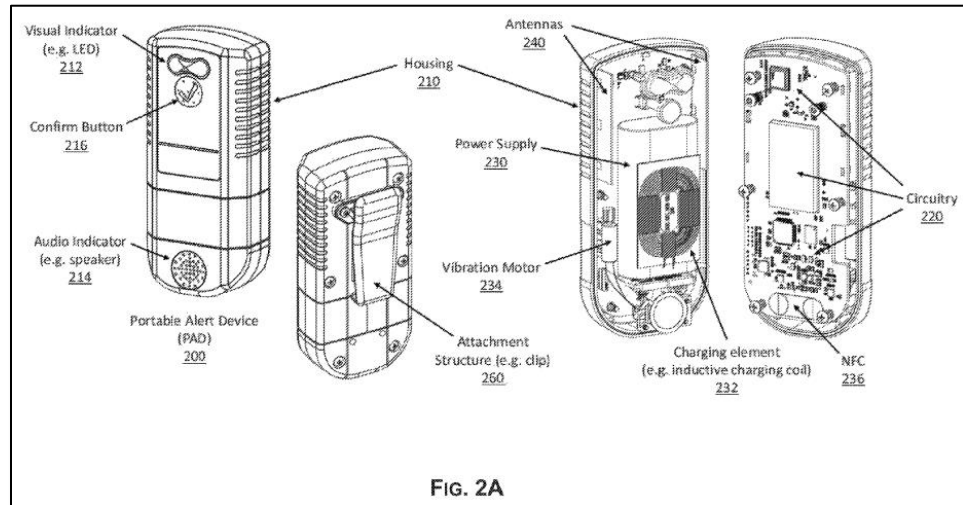
Figure 1B depicts a system with the VAD (blue), WDU (green), and PADs (red) highlighted:



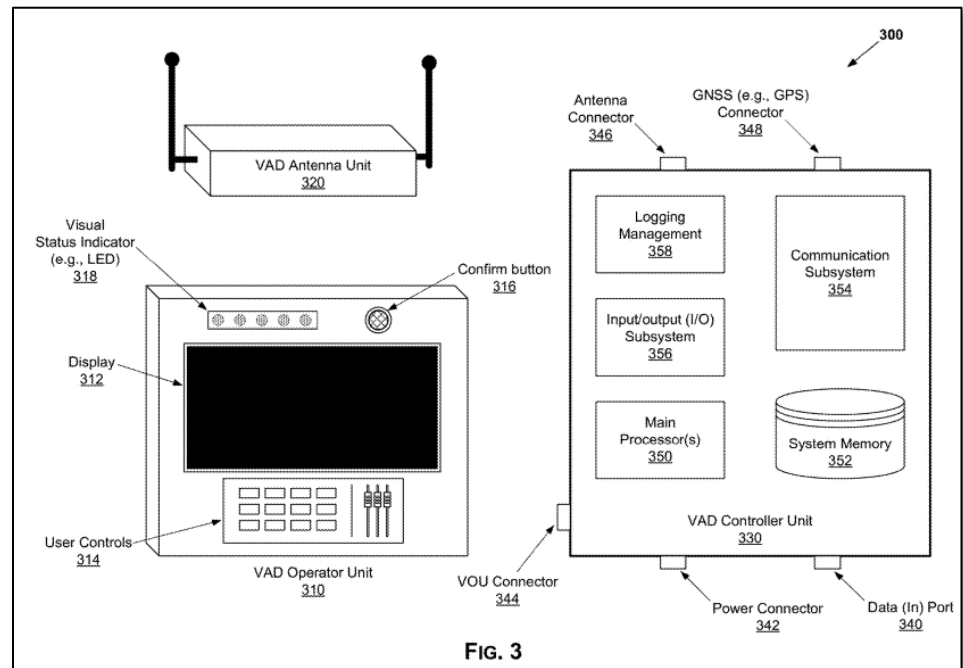
The PAD, VAD, and WDU each comprises conventional components for transmitting, receiving, and processing wireless signals like an “antenna” or

“processor.” 8:29-10:49 (describing PAD), 10:50-13:47 (describing VAD), 13:48-31 (describing WDU); Braasch-Decl., ¶¶30-49. Figures 2A-4 depict the devices:

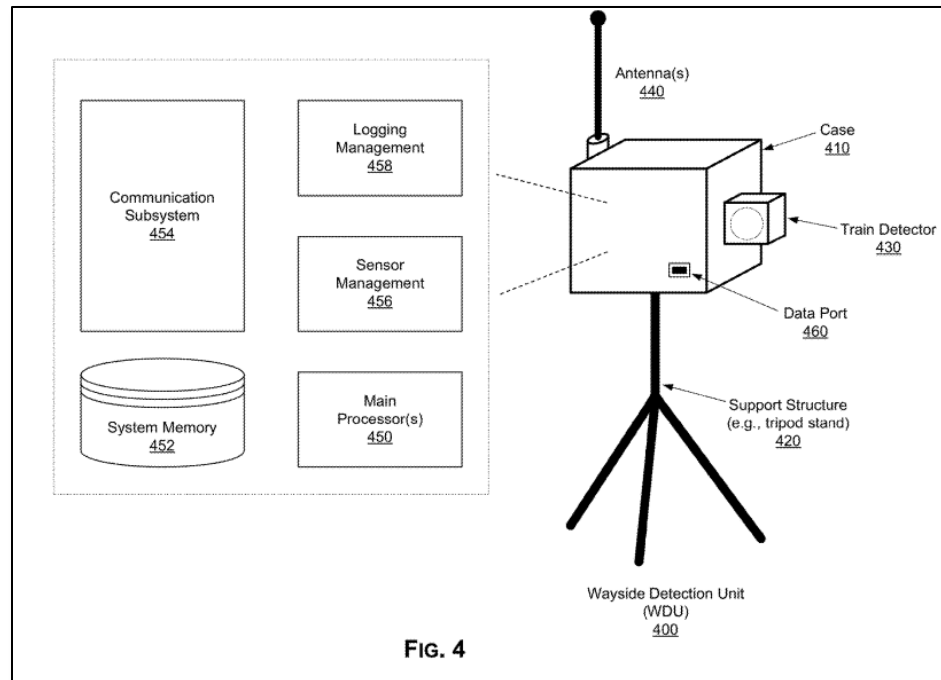
PAD



VAD



WDU



As seen above, each device is configured for its particular application. Braasch-Decl., ¶30. For example, the PAD can be a “small and light device” with a clip for attaching to a worker. 2:65-3:2. It also has audio-visual indicators that are “configured to provide visual and/or audio indication in response to triggering of alerts” (9:15-26) and “an alert acknowledgement element, such as a confirmation button to silence alarms” (3:10-13). The VAD includes an “operator unit” with a “user interface” that “provide[s] the vehicle operator” with “alert related data” (*e.g.*, “distance to the workers”). 11:16-66. The WDU includes sensors that “monitor, detect, and track [an] approach[ing] vehicle,” and “support structure” that allows the WDU to be placed “near train tracks.” 14:5-26.

A. Challenged Claims

Challenged system claims 1-30 are reproduced in the Claim Listing. *Infra* §X. The claims are directed to systems including one of the three devices discussed in the specification.

- Independent claim 1 and dependent claims 2-19 recite a system including a “wearable personal alert device.”
- Independent claim 20 and dependent claims 21-26 recite a system including a “vehicle-mounted alert device.”
- Independent claim 27 and dependent claims 28-30 recite a system including a “wayside detection unit.”

Each independent claim further recites basic components its respective device includes (*e.g.*, “housing,” “antennas,” “circuits”) and describes alert-related operations the device performs, *e.g.*, “generate...a safety alert” (claim 1), “broadcast alert triggering signals” (claim 21), or “broadcast...alert related signals” (claim 27).

The dependent claims add conventional features of electronic devices and well-known features of safety-alert systems. For example, claims 2-5 add conventional power-management techniques, and claim 6 generically recites using prior art antenna-diversity techniques. These and other conventional features added by other dependent claims were well-known in the prior art, and POSAs had reason to implement them in worker-protection systems. Braasch-Decl., ¶¶54-56.

B. Level of Ordinary Skill in the Art

POSAs would have had a background in wireless electronics, including at least a bachelor's degree in electrical engineering or a related field, and would have at least two years of experience with using such electronics for control systems applications such as collision-avoidance systems or positioning systems. Braasch-Decl., ¶27.

C. Prosecution History

The as-filed application included thirty claims. EX1002, 166-172. The examiner rejected claims 1-20 over U.S. Patent Application 2011/0006912 (“Sheardown”), which is not relied on here. *Id.*, 62-69. For reasons unknown, the Examiner failed to address independent claims 21 and 27 (and dependent claims 22-26 and 28-30) **at all** in the initial office action. *Id.*, 62; *see also id.*, 31 (applicant noting examiner’s “oversight”).

Metrom amended claim 1 into its issued form by limiting the “personal alert device” of the claimed system to one that received signals from a companion device that “is deployed locally in proximity of the personal alert device and/or within vehicles operating in areas serviced by workers.” *Id.*, 23-37. The Examiner then allowed claims 1-20, as well as the previously unaddressed claims 21-30, without providing reasoning and without (apparently) substantively examining claims 21-30. *Id.*, 15.

VI. CLAIM INTERPRETATION

Claim limitations are construed according to their ordinary meaning in light of the specification and prosecution history. 37 C.F.R. § 42.100(b). Because the prior art plainly discloses the claim limitations, no express constructions are necessary. *Vivid Techs. v. Am. Sci. & Eng'g*, 200 F3d 795, 803 (Fed. Cir. 1999).

VII. GROUNDS FOR UNPATENTABILITY

A. Ground 1A: Claims 1, 7-15, 19-25: Anticipated and/or Obvious Over Cross³

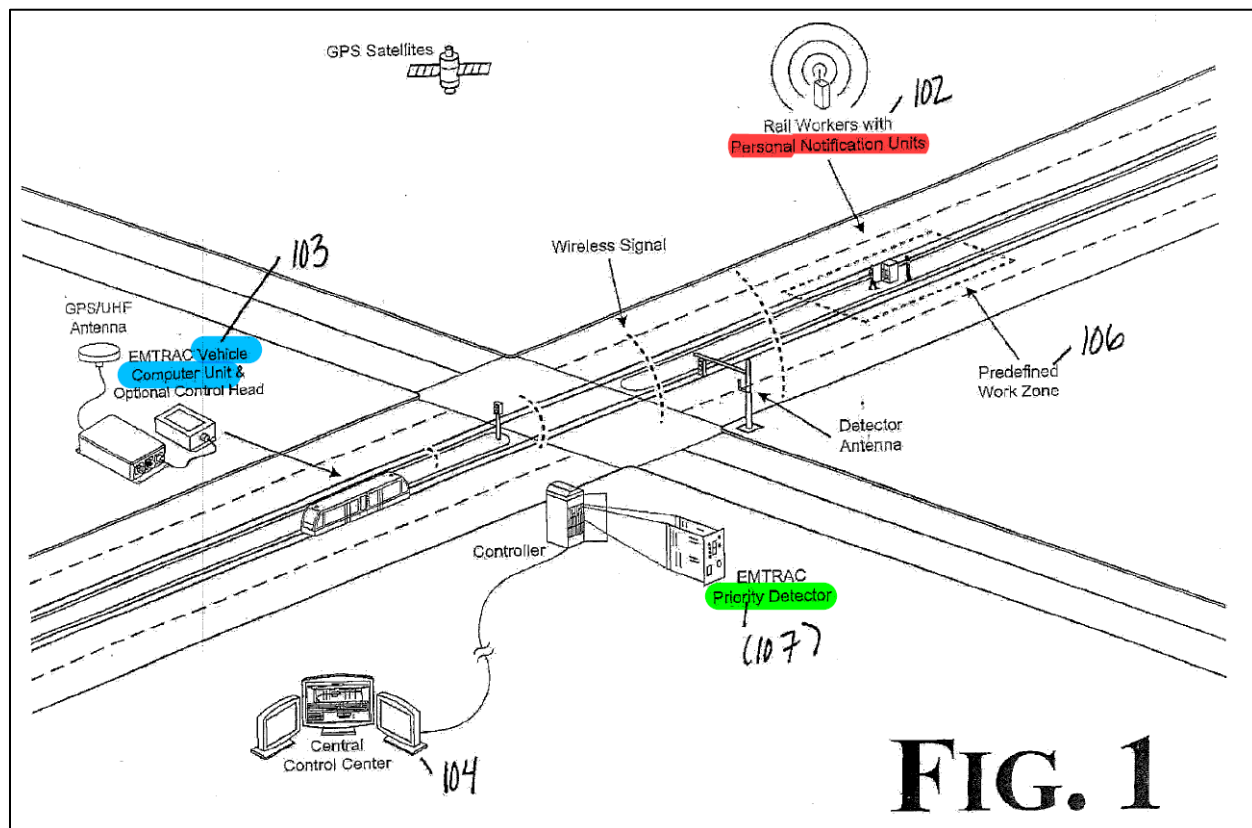
1. Cross (EX1007)

Like the '595 patent, Cross discloses a “safety notification system” wherein workers are warned of approaching trains and train-operators are warned of nearby workers. Abstract, [001]-Summary⁴, [026]. Also like the '595 patent, Cross's system relies on three companion devices: (1) “worker equipment” called a “personal notification unit (PNU)”, (2) “mass transit equipment unit” called a “vehicle computer unit (VCU),” and (3) “wayside devices” called “priority

³ Unless otherwise noted, Section VII.A's citations are to Cross.

⁴ Cross's “Background” (pp. 1-2) and “Summary of the Invention” (pp. 3-7) each include paragraphs [001]-[005]. To avoid confusion, Petitioners have appended “Background” or “Summary” to paragraph [001]-[005] citations, *e.g.*, [001]-Background or [001]-Summary.

detectors.” [029], [049]; FIG. 1 (elements 102, 103, and 107); Braasch-Decl., ¶¶60-62. Cross’s Figure 1 depicts a system with all three components:



In operation, the PNUs and VCUs send/receive “location-based package data” over a network. [029]-[031]; Braasch-Decl., ¶¶63-64. Based on the exchanged location-based data, the PNU, VCU, or a central control server can trigger an alert mode that generates alert signals. [030]. These alert signals “notify a worker equipped with a PNU [], a vehicle operator, or an administrator of a potentially dangerous interaction between an equipped worker and a vehicle.” *Id.*; Braasch-Decl., ¶64.

The PNU is a “hardware device” that attaches to workers via “a clip.” [045]; FIG. 2. It “receive[s] GPS” signals, “transmit[s] its location data,” and “stor[es] detailed activity and alert logs.” [041]. The PNU has “four main functions”: (1) “transmit[ting]...location data of the worker”; (2) “receiv[ing] communications and information” from other devices (*e.g.*, VCUs and priority detectors); (3) “identify[ing] alert mode conditions”; and (4) “transmit[ing] audible, movement or visual warning to a worker.” [043]. When in “alert mode,” the PNU “send[s] out an alert” to the worker and “transmit[s] a special high alert packet into the network and [to] each of the components of the network to notify them of the alert situation.” [044]; Braasch-Decl., ¶¶65-67.

The VCU is either a permanently-installed or mobile unit placed inside a train. [038]. The VCU receives information (*e.g.*, alert signals) from other devices in the system (*e.g.*, PNUs), and transmits its own “automatic vehicle location (AVL) packets” to those other devices. [036]-[038]. The VCU performs “real-time monitoring and display of worker activity and locations on a user interface,” like a “tablet computer.” [039]; Braasch-Decl., ¶¶68-70.

The wayside priority detectors are devices located at various points along the train’s route (*e.g.*, at an intersection), and they operate as intermediaries that receive wireless signals from, and forward wireless signals to, other devices in the system (*e.g.*, PNUs, VCUs). [048]; Braasch-Decl., ¶71.

2. Claim 1

a. [1PRE] 1. A system for worker protection, the system comprises:

Cross discloses “a safety notification system” for protecting “maintenance workers.” [001]-Summary; *see also* [002]-Background, [046], [050]; Braasch-Decl., ¶¶72-73.

b. [1A] a compact wearable personal alert device, configured for use by a worker,

Cross’s “personal notification unit (PNU)” is a “small, portable device” that is “worn by a...worker.” [029], [041], [045]; *see also* [002]-Summary, [022], [061], FIG. 2; Braasch-Decl., ¶74.

c. [1B] the personal alert device comprising: a housing for enclosing components of the personal alert device;

PNU components (*e.g.*, transmitter/receiver, *infra* §§VII.A.2.e-VII.A.2.f (limitations [1D], [1E])) are enclosed in a “hardware” housing, *e.g.*, FIG. 2’s housing below. [045]; Braasch-Decl., ¶75.



- d. **[1C] an attachment structure for attaching the personal alert device to the worker or an item used by the worker;**

The PNU is “attached to an individual rail-maintenance worker” using a “clip,” which is “*an attachment structure*,” as claimed. [045], FIG. 2; Braasch-Decl., ¶76; *see also* EX1001, claim 15. Alternatively, the PNU is “attached to [a] piece of safety equipment” used by a worker. [045], Braasch-Decl., ¶76.

- e. **[1D] a power supply for powering components of the personal alert device;**

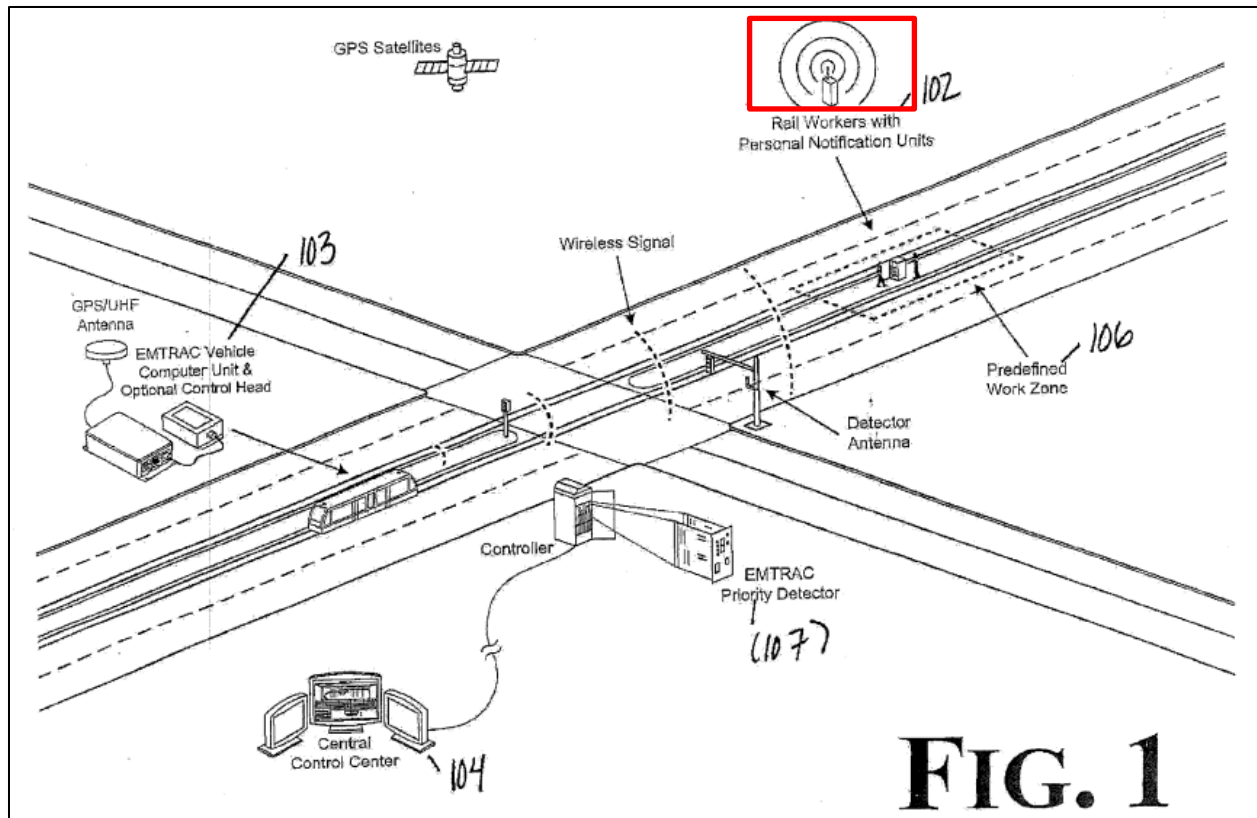
The PNU “contains a power source”—*e.g.*, “batteries”—for powering its components. [042], [063]; Braasch-Decl., ¶77.

- f. **[1E] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;**

The PNU includes a transmitter and receiver that “produce” and “receiv[e],” respectively, radio signals, *i.e.*, wireless signals. [031], [041], [048] (system uses “a wireless network”), FIG. 1 (illustrating “wireless signals”). Braasch-Decl., ¶78.

Wireless communication devices—like the PNU—use antennas to transmit/receive wireless signals. Braasch-Decl., ¶79. Cross’s Figure 2 (below) depicts an antenna on the PNU and Figure 1 (below) depicts wireless signals radiating from it (Braasch, ¶¶80-82):





- g. [1F] one or more indicator components, for outputting alert indications; and

The PNU includes indicator components (*e.g.*, “speakers,” “LEDs”) that output “audio...and visual alert signals.” [043]; *see also* [030], [044], [057], [059]; Braasch-Decl., ¶83.

- h. [1G] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the personal alert device;

The ’595 patent broadly defines a “circuit” as “physical electronic components,” *e.g.*, a “processor and memory,” and “software” associated with,

executed by, or which configures those components. EX1001, 1:63-2:4; Braasch-Decl., ¶84.

Cross's PNU includes a "computer," which Cross describes as "inclusive of all computational devices," including a "processor[]." [031]-[032]. Cross's "processor" (and the software it executes) is a "circuit," as defined by the '595 patent. Braasch-Decl., ¶85.

The PNU's computer (*i.e.*, processor) "serves four main functions." [043]. These functions "*relat[e] to operations of the personal alert device*," as claimed, like "transmit[ting]...location data of the worker," "identify[ing] alert mode conditions," and "transmit[ting] audible, movement or visual warnings to a worker." [043]; Braasch-Decl., ¶¶86-87.

- i. **[1H1] wherein the personal alert device is operable to: process signals received from a companion alert device, wherein the companion alert device is deployed locally in proximity of the personal alert device and/or within vehicles operating in areas service by workers;**

In operation, the PNU "receiv[es] communications," *i.e.*, wireless signals, from companion alert devices like VCUs—*i.e.*, devices "*within vehicles operating in areas serviced by workers*," as claimed—and wayside-located priority detectors—*i.e.*, devices "*deployed locally in proximity of the personal alert device*," as claimed. [041]; *see also* FIG. 1 (depicting vehicle-mounted VCU and wayside-located priority detector deployed near workers), [029]-[030], [034], [038] (VCUs send

“automatic vehicle location (AVL) packets” to PNUs), [040] (VCUs send warning signals to PNUs), [043] (PNUs receive “communications and information” from VCUs), [049] (wayside priority detectors/units “forward[...alert notifications...to...PNUs”), [056], [061]; Braasch-Decl., ¶¶88-89. The PNU processes signals received from these companion devices, as explained *infra* §§VII.A.2.j-VII.A.2.k (limitations 1H2-1H3). Braasch-Decl., ¶¶89-90.

j. [1H2] generate, in response to signals received from the companion alert device, a safety alert; and

In response to “receiv[ing] communications and information from” the VCUs and/or wayside detectors (*e.g.*, AVL packets), the PNU’s computer “can identify alert mode conditions” and if it “determines that an alert condition is present,” the PNU enters “alert mode.” [043]-[044]; *see also* [049], [056], [061]; Braasch-Decl., ¶91. The determination that an “alert mode” exists is a “*safety alert*,” as claimed, that the PNU’s computer generates in response to received signals from the VCUs and/or wayside detectors (*e.g.*, AVL packets). Braasch-Decl., ¶92.

k. [1H3] output, via the one or more indicator components, one or more alert indications to the worker based on the safety alert.

Once in an “alert mode,” the PNU’s computer outputs “audio, movement and visual alert signals” via its indicator components. [043], [056], [061]; Braasch-Decl., ¶93-94; *supra* §VII.A.2.g (limitation 1F) (discussing “indictor components”).

The alert indications are output based on the existence of an “alert mode,” *i.e.*, “*based on the safety alert*,” as claimed.

3. Claim 7: The system of claim 1, wherein triggering of alerts and/or broadcast of signals triggering of the alerts is based on one or more types of alert thresholds.

The PNU identifies whether an “alert mode condition” exists (thereby triggering an alert signal) based on information the PNU receives such as the location of a train equipped with a VCU. [043]-[044], [050]. For example, “an alert mode is triggered by the PNU [] when, based on the AVL packet received by [an] approaching vehicle, it is determined that the PNU [] is within a...***defined estimated time of arrival*** of the approaching vehicle.” [057]. The “defined estimated time of arrival,” which “can be modified and changed” ([057]), is an “*alert threshold*,” as claimed. Braasch-Decl., ¶¶95-96; *see also infra* §VII.A.4 (claim 8) (identifying “ETA” as an “alert threshold”); Cross, [023] (describing Figure 3 as depicting safety system using “estimate time of arrival”), [055] (describing “ETA” and “distance away” as adjustable parameters for triggering alerts); [056] (describing use of “ETA” to trigger PNU to alert when train approaches a pre-defined “warning area”); [058] (describing “ETA” as an alert-triggering parameter); claim 19 (reciting that “alert mode” is triggered based on, *inter alia*, “certain defined variable”).

4. **Claim 8: The system of claim 7, where the one or more types of alert thresholds comprise time-to-arrival (TTA), distance-from-train (DFT), and low-speed close proximity distance alert (CPD).**

As discussed above for claim 7, one alert threshold the PNU utilizes is estimated-time-of-arrival which is “*time-to-arrival*,” as claimed. [057]; Braasch-Decl., ¶97. The PNU “can be set up and adjusted to alert at a given distance away (*e.g.*, 2 miles away regardless of direction of travel)” [055], which is “*distance-from train*,” as claimed.

5. **Claim 9: The system of claim 1, wherein the personal alert device is operable to communicate with one or more nearby alert devices, to forward received signals and/or alerts generated in response to the received signals among the personal alert device and the one or more nearby alert devices.**

As discussed for claims 7-8, a PNU identifies an “alert mode” based on the location of an approaching vehicle. [043]-[044], [057]. When in an “alert mode,” in addition to sending alert signals to the worker, the PNU “transmit[s] a special high alert packet into the network and [to] each of the components of the network,” which is “*forward[ing]...alerts generated in response to the received signals (supra §§VII.A.2.i-VII.A.2.j (limitations 1H1, 1H2)) among the personal alert device and nearby alert devices*,” as claimed. [044], [061]-[062] (“Alert modes...triggered by the PNU” are “transmitted to the other components of the system.”); Braasch-Decl., ¶¶98-99.

Alternatively, Cross teaches forwarding signals in its system and describes using wayside-located priority detectors to perform such forwarding. Cross, [049]. In view of Cross’s teaching, POSAs would have had reason to provide each component in Cross’s system—including PNUs—with the ability to forward received signals—*e.g.*, AVL packets from VCUs—to nearby companion devices so as to make the worker protection system more robust by ensuring that all at-risk devices timely received alert-triggering signals. Braasch-Decl., ¶100. This would have been using a known technique (forwarding received signals) to improve similar devices (portable safety devices) in a predictable way (increasing the likelihood that safety devices received alert-triggering signals). *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 417 (2008); Braasch-Decl., ¶¶101-103 (citing EX1020, [0070]; EX1021, [0114] as corroboration).

6. Claim 10: The system of claim 1, wherein the personal alert device is operable to log data relating to alerts triggered and/or handled by the personal alert device.

The PNU “stor[es] detailed activity and alert logs” relating to at least the alerts it triggered. [041]; *see also* [013] (PNUs store “alert logs”), [047] (“alert logs” stored on “each...PNU”), claim 14; Braasch-Decl., ¶¶104-105.

7. **Claim 11: The system of claim 1, wherein the companion alert device comprises a vehicle-mounted alert device, a wayside detection unit, or another personal alert device.**

As discussed *supra* §VII.A.2.i-VII.A.2.j, Cross’s companion alert devices comprise (i) vehicle-mounted devices, *i.e.*, VCUs, and (ii) wayside detection units, *i.e.*, wayside priority detectors, and other personal-alert devices, *i.e.*, PNUs. [029]-[030], [041], [049], FIG. 1 (elements 102, 103, 107); Braasch-Decl., ¶¶106-107.

8. **Claim 12: The system of claim 1, wherein the one or more indicator components comprise at least one of visual indicator, audio indicator, and a tactile indicator.**

PNU indicator components (*supra* §VII.A.2.g (limitation 1F)) include “LEDs, vibrations and high[-]volume speakers,” which are visual, tactile, and audio indicators. [043]; Braasch-Decl., ¶108.

9. **Claim 13: The system of claim 1, wherein the power supply comprises a rechargeable power supply.**

The PNU’s power supply (*supra* §VII.A.2.e (limitation 1D)) comprises “recharging” (*i.e.*, rechargeable) batteries. [042]-[043], [063]; Braasch-Decl., ¶109

10. **Claim 15: The system of claim 1, wherein the attachment structure comprises a clip structure or a strap structure.**

The PNU’s attachment structure comprises a “clip.” [045]; Braasch-Decl., ¶110.

11. Claim 19: The system of claim 1, wherein the personal alert device is operable to implement configurable alarm management for allowing setting and/or adjusting of rules controlling triggering and/or handling of alerts.

As discussed with respect to claims 7-8, PNUs enter an alert mode based on a “defined” threshold ETA of a vehicle, *e.g.*, “20 seconds prior to arrival.” [055], [057]. The “defined” ETA that triggers an alert “can be modified or changed,” ([057]), *i.e.*, it can be changed from “20 seconds prior to arrival” to, *e.g.*, 10 seconds prior to arrival. Braasch-Decl., ¶111. The PNU is thus “*operable to implement configurable alarm management for setting/adjusting of rules controlling the triggering of alerts,*” as claimed. Braasch-Decl., ¶112.

12. Claim 20

a. [20A]: 20. The system of claim 1, wherein the personal alert device is operable to: receive Global Navigation Satellite System (GNSS) signals;

The PNU is “capable of receiving GPS,” which is a type of GNSS signal. [0047], [0040]; Braasch-Decl., ¶113; *see also* EX1001, 4:31-37 (explaining that GNSS signals include “GPS”).

b. [20B] determine location information based on the received GNSS signals; and

The PNU uses GPS “positioning system” signals to “determine[e] the worker’s position.” [041]; [034] (satellite “receiver...calculate[s] its position by precisely timing the signals sent by satellites”), [059]; Braasch-Decl., ¶114.

- c. **[20C] utilize the location information in conjunction with at least one of the operations of the personal alert device.**

As explained *supra* §VII.A.2.h (limitation 1G), one operation of the PNU is “transmit[ting]...location data of the worker.” [041]. The PNU uses its “satellite positioning system,” *i.e.*, GPS, to “determin[e] the worker’s position.” *Id.* Braasch-Decl., ¶¶115-116.

13. Claim 21

- a. **[21PRE] A system for worker protection comprises:**

Supra §VII.A.2.a (limitation [1PRE]). Braasch-Decl., ¶117.

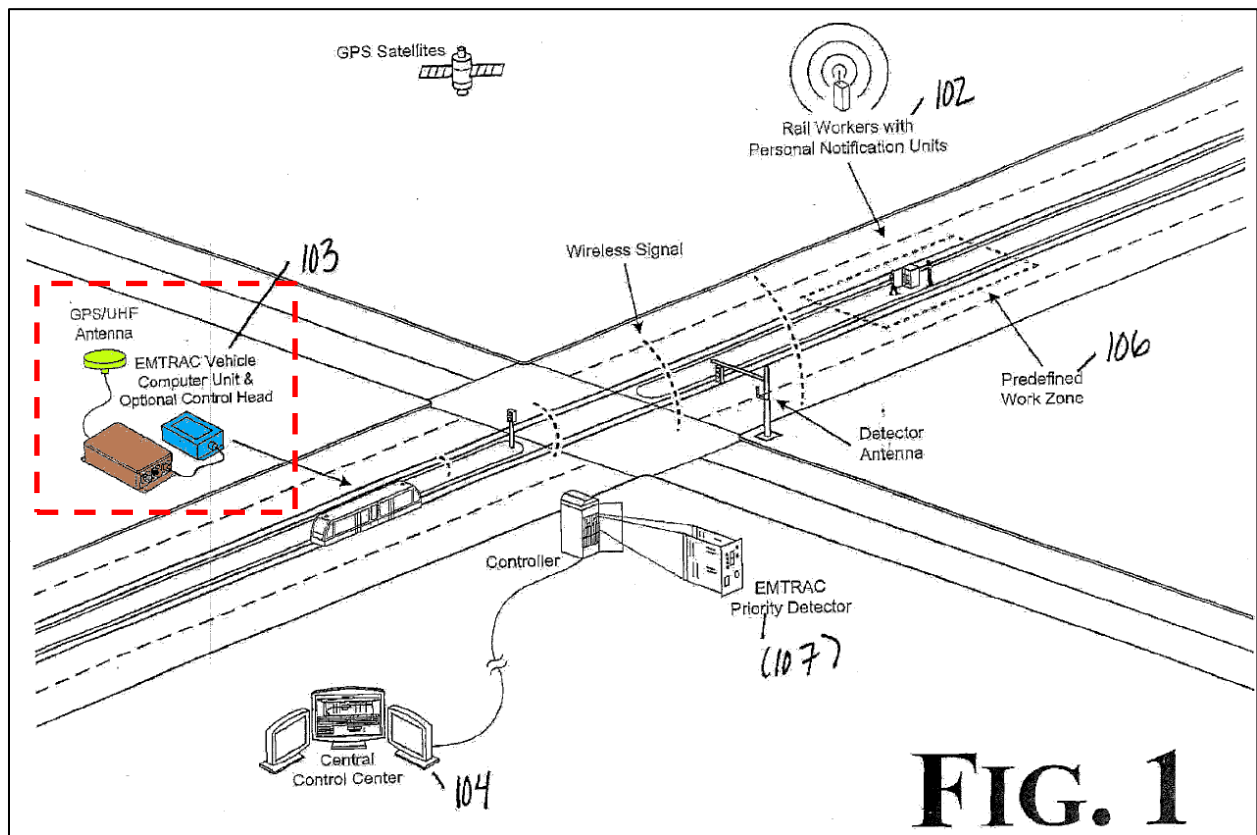
- b. **[21A] a vehicle-mounted alert device, configured for use on a vehicle**

Cross includes a “vehicle computer unit (VCU)” that is an “onboard unit” whose installation “into [a] mass transit vehicle” can be “either permanent—by direct integration into the [] vehicle”—“or temporary, through a mobile receiver that can be taken into and removed from the vehicle.” [029], [034]-[035]. In either implementation, the VCU is “*configured for use on a vehicle*,” as claimed. Braasch-Decl., ¶118; *infra* §VII.A.14 (discussing claim 22).

- c. **[21B] the vehicle-mounted alert device comprising:
a housing for enclosing components of the vehicle-mounted alert device;**

The VCU includes components like “a receiver” or “computer.” [031]-[032].

As illustrated in Figure 1 (below), the VCU's components are enclosed in housings, including a housing for a "mobile receiver that can be taken into and removed from the vehicle." Cross, [035]; Braasch-Decl., ¶119. When the VCU is not a mobile unit and is instead permanently installed "by direct integration into the [] vehicle" (Cross, [035]), the VCU's components would have been housed within the vehicle itself. Braasch-Decl., ¶¶120-121.



d. [21C] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;

As Figure 1 (above) illustrates, the VCU has a “GPS/UHF Antenna.” The VCU also has a transmitter/receiver that, using the antenna, “produce” and “receiv[e],” respectively, radio signals, *i.e.*, wireless signals. [031], [033]; Braasch-Decl., ¶¶122-123. The VCU’s antenna is “*a communication component*,” as claimed. Braasch-Decl., ¶124.

e. [21D] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the vehicle-mounted alert device; and

The VCU includes a “computer,” which Cross broadly defines as including a “processor.” [031]-[032]; *supra* §VII.A.2.h (explaining Cross’s “computer,” *i.e.*, “processor,” is a “*circuit*”). The VCU’s computer processes “inputs received” from PNUs (*i.e.*, signals and the data they contain) and performs various functions relating to the VCU’s operation including (i) “send[ing] safety signals to and receiv[ing] safety signals from PNUs” and/or (ii) “instruct[ing] the train to gradually slow down.” Cross, [036]-[037]. Braasch-Decl., ¶¶125-126.

The VCU’s receiver is another “electronic circuit,” which performs “processing and converting [of] the [received] signal...into usable form” ([031]) for use in VCU functions like “track[ing] real-time vehicle location, transmit[ing]

approaching vehicle-alerts, ...alter[ing] vehicle function, and stor[ing] activity logs” ([034]). Braasch-Decl., ¶¶127-128.

f. [21E] one or more input/output (I/O) components, for receiving input from an operator of the vehicle and/or for providing output to the operator of the vehicle;

The VCU “allows for the real-time monitoring and display of worker activity and locations on a *user interface*.” [039]. The “user interface” can take the form of a “tablet computer.” *Id.* When implemented as a tablet, the user interface is an I/O component. Braasch-Decl., ¶129; *see also* EX1001, 11:16-46 (exemplary I/O components include “display” with “touch screen”).

Through its user interface, the VCU produces outputs. For example, the user interface, *e.g.*, tablet, “displays the location” of VCUs and PNUs. [012]; *see also* [039]; Braasch-Decl., ¶130.

Through its user interface (*e.g.*, tablet), the VCU receives inputs and/or it would have been obvious to implement the VCU such that it received input via its user interface. For example, a train operator can “manually” instruct the VCU to issue an AVL packet into the network. [038]. POSAs would have understood that the operator issued such an instruction through the VCU’s user interface, *e.g.*, tablet. Braasch-Decl., ¶131. Similarly, the VCU can “set up and adjust” how PNUs respond to alert signals as well as “create[], modif[y], delete[] or otherwise control[]” warning areas. Cross, [055]. POSAs would have understood that the operator

caused the VCU to perform these system adjustments via inputs to the user interface, *e.g.*, tablet. Braasch-Decl., ¶131.

If Cross is found not to disclose that operators input instructions/commands to the VCU via its user interface, then POSAs would have had reason to implement Cross such that its user interface, *e.g.*, tablet, received such inputs because electronic devices—like the VCU—conventionally received inputs from their I/O component, like the VCU’s tablet. Braasch-Decl., ¶¶132-133.

g. [21F1] wherein the vehicle-mounted alert device is operable to: broadcast alert triggering signals; and

The ’595 patent uses “broadcast” in its ordinary sense, *i.e.*, the transmission of a signal to multiple devices simultaneously using a one-to-many model, rather than a one-to-one model. Braasch-Decl., ¶134; EX1001, 7:21-30 (vehicle unit “broadcasts signals” to worker-worn “PADs” [plural]); 7:40-55 (alarm is “broadcast” to “all local PADs”); 10:59-11:3; EX1036 (defining “broadcast” as “[t]o communicate or transmit...to numerous recipients simultaneously”); EX1038-EX1040 (similar).

Using an ultra-high frequency (UHF) transmission spectrum ([033]), Cross’s VCU “send[s] automatic vehicle location (AVL) packets to the other components of the networks, in particular to the plurality of PNUs (102) in the network” ([038]). *See also id.* [034] (explaining VCU sends communications to “a plurality of PNUs”), [035] (VCU’s “transmitter functions to transmit information and radio signals to a

plurality of PNUs”), [043]-[044]. The conventional technique for a single transmitting device to send wireless data packets simultaneously to a “plurality” of devices, including in a UHF-based network, was to “broadcast” the data packet, *i.e.*, transmit the data packet to a plurality of devices simultaneously. Braasch-Decl., ¶135.

If Cross is not considered to disclose that its VCU “broadcasts” AVL packets, then POSAs would have recognized the benefit of implementing the VCU such that it did broadcast its AVL packets because doing so would ensure that all companion devices within range of the VCU’s transmitter—both known and ***unknown*** to the VCU—received the AVL packets. Braasch-Decl., ¶136 (citing Meyer, [0017], [0036]; EX1022, [0003]-[0004]).

“[A]n alert mode is triggered by” PNUs based on received AVL packets, which are processed by PNUs to determine a vehicle’s “route and bearing” and/or “location.” [030], [043] (explaining PNU “can identify alert mode conditions” based in part on “location data received from the plurality of VCUs,” *i.e.*, AVL packets); [056]-[057] (“alert mode is triggered by the PNU...based on the AVL packet received by [sic: from] the approaching vehicle”), [043]; Braasch-Decl., ¶137. AVL packets broadcast by VCUs are “*alert triggering signals*,” as claimed. Braasch-Decl., ¶137.

h. [21F2] generate, in response to triggering of alerts, data relating to alerts and/or to other devices or objects in path of the vehicle; and

In response to sending an AVL packet that triggers a PNU to issue an alert, the VCU computer generates data relating to the alert and/or other companion devices in the path of the vehicle. Braasch-Decl., ¶138. For example, the VCU computer “create[s] detailed logs and reports which *show worker location* and *alert histories* along the route.” [039]. Additionally, when an alert mode is activated in the system, the VCU generates data needed to initiate “alert signals” that “notify...a vehicle operator...of a potentially dangerous interaction between an equipped worker and a vehicle within the grid.” [030], [052]; Braasch-Decl., ¶¶139-140.

i. [21F3] output based on the data, via the one or more I/O components, feedback information to the operator.

Based on the above-described generated data (*supra* §VII.A.13.h (limitation [21F2])), the VCU outputs feedback information to the operator. For example, the VCU outputs “detailed logs and reports which *show* worker location and alert histories along the route.” [039]. POSAs would have understood that such logs/reports would have been accessible to the vehicle operator, *e.g.*, via the VCU’s user interface, and/or POSAs would have had reason to make them accessible to the operator, *e.g.*, so that the operator knows when/where alerts occurred over the course of the route. Similarly, the VCU outputs “alert signals” that “notify” the vehicle

operator of an impending dangerous situation—such alerts are also a form of “feedback” to the operator that is based on the data generated in response to the VCU triggering alerts on a PNU. [030], [052]; Braasch-Decl., ¶¶141-142.

14. Claim 22: The system of claim 21, wherein the vehicle-mounted alert device is configured, at least in part, as portable, detachable and movable from the vehicle.

The VCU is configurable as a “temporar[ily]” installed “mobile receiver that can be taken into and removed from the vehicle,” and thus is “*portable, detachable and movable from the vehicle*,” as claimed. [035], FIG. 1; Braasch-Decl., ¶143. If Cross is not considered to disclose that its mobile VCU is attachable to and “*detachable*” from the train, then POSAs had reason to implement such a design, *e.g.*, to ensure that its components were secure within the train. Braasch-Decl., ¶143.

The VCU’s user interface implemented as a tablet (*supra* §VII.A.13.f (limitation [21E])), also meets claim 22 as POSAs would have understood the tablet was attachable/detachable to/from the vehicle, *e.g.*, for charging or securing, and/or would have implemented it as attachable/detachable for those reasons. [039]; Braasch-Decl., ¶143.

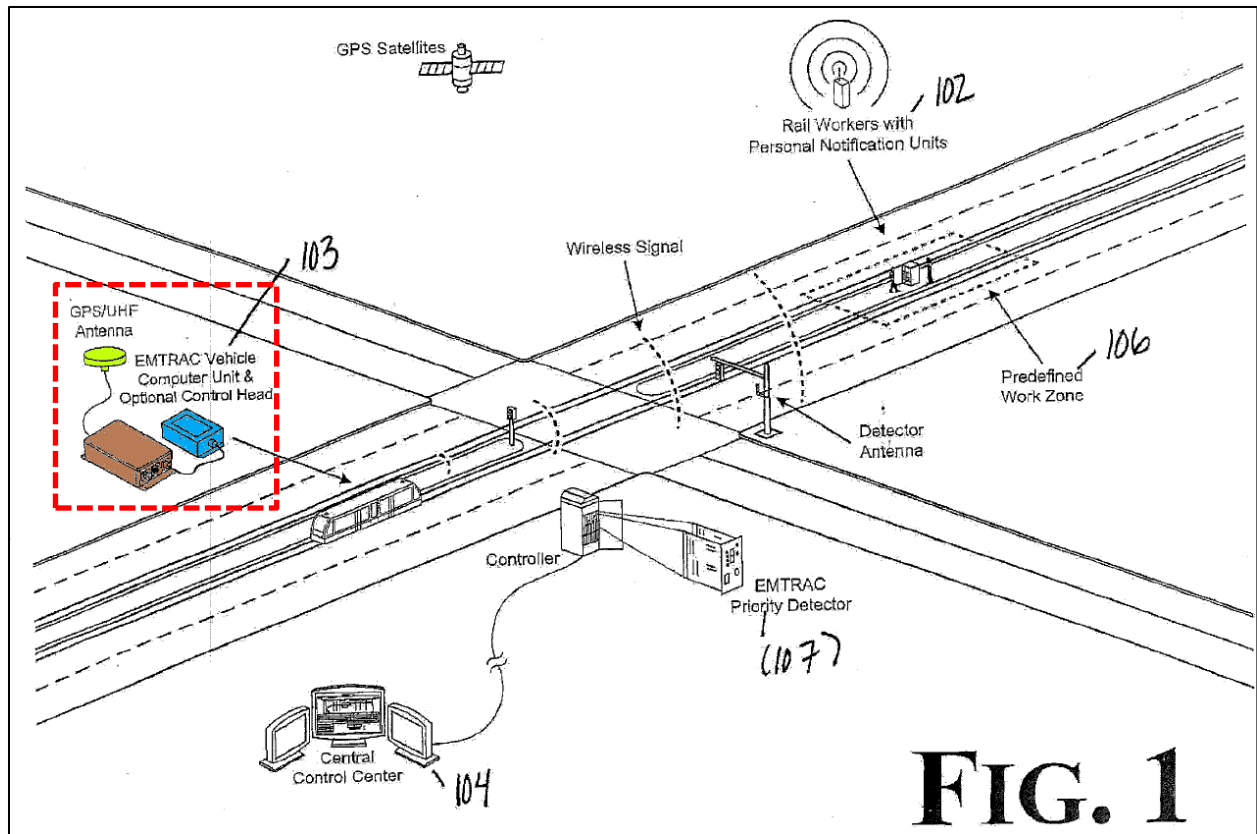
15. Claim 23: “The system of claim 21, wherein the vehicle-mounted alert device is operable to log data relating to alerts triggered in response to movement of the vehicle.”

The VCU’s computer is operable “to create detailed logs and reports which show...alert histories along the route.” [039], [034]. The alert histories relate to the

triggered alerts discussed *supra* §§VII.A.7, VII.A.13.g-VII.A.13.h (claim 7 and limitations [21F1]-[21F2]), which are triggered in response to movement of the vehicle, *e.g.*, based on vehicle-movement information conveyed in AVL packets and/or when the vehicle approaches PNUs or a pre-defined “warning zone.” [027], [034]-[036], [038], [051], [061], FIGS. 3-4; Braasch-Decl., ¶¶144-145.

16. **Claim 24: The system of claim 21, wherein the vehicle-mounted alert device is arranged into a plurality of separate physical units that comprises at least a broadcast unit comprising at least the communication component, the broadcast unit is configured to attachment external to the vehicle.**

Cross’s Figure 1 (below) illustrates that the VCU comprises three separate physical units: (1) “onboard vehicle computer unit”; (2) antenna; and (3) “optional control head.” Such physical separation of the VCU’s computer from its antenna is consistent with the ’595 patent’s description of a vehicle alert device. EX1001, 3:41-57.



The antenna (green) is a broadcast unit that includes the VCU's communication component—*i.e.*, the antenna itself, *supra* §VII.A.13.d (limitation 21C). Cross's text does not explicitly state where each VCU's antenna is mounted on the vehicle, but POSAs would have had reason to configure the VCU's antenna for attachment external to the vehicle, as claimed. Braasch-Decl., ¶¶146-147.

In general, there would have been two locations to mount the antenna: inside or outside the vehicle. The top of, *i.e.*, external to, a vehicle was a conventional location for placing an antenna because the location improves line-of-sight thereby reducing interference and improving antenna performance. Braasch-Decl., ¶147

(citing EX1024, 1:30-42, EX1025, [0006], Carlson, [0056]). Indeed, another prior-art application that Cross’s first-named inventor filed discloses mounting a similar combination GPS/UHF antenna “*on top of*” a vehicle. EX1033, [0039]; FIGS. 1-2. Accordingly, implementing Cross such that its antenna(s) are configured for attachment external to the vehicle, as claimed, would have been obvious to POSAs in view of their general knowledge of conventional antenna placement. Braasch-Decl., ¶¶148-149.

17. Claim 25: The system of claim 24, wherein the plurality of separate physical units comprises an operator unit comprising at least the one or more I/O components, the operator unit is configured for use by the operator.

As discussed *supra* §VII.A.13.f (limitation [21E]), each VCU includes a “user interface” (“*an operator unit*,” as claimed) comprising I/O components. The user interface, *e.g.*, a “tablet” ([039]), is a separate physical unit of the VCU. Braasch-Decl., ¶150.

The user interface is configured for use by the operator to receive inputs and/or provide outputs, as discussed *supra* §§VII.A.13.f, VII.A.13.i (limitations [21E], [21F3]). [039]; Braasch-Decl., ¶151.

B. Ground 1B: Claims 2-5: Obvious Over Cross and Mantovani

Claims 2-5 limit claim 1’s personal alert device to one that includes conventional power-savings techniques.

1. Mantovani (EX1009)⁵

Mantovani discloses a method that “saves power in a location enabled, energy constrained device by...eliminating unneeded position information updates.” [0012]. As Mantovani explains, “battery operated” mobile devices “need to be power efficient,” but they are also conventionally “equipped with device position determinators, such as [GPS] measurement circuitry” that draw power. [0002], [0004]. Mantovani discloses methods for reducing power that position determinators—like GPS circuits—draw. [0012].

In an embodiment, when an electronic device receives a request for its position, a determination is made whether the device has moved since the last time its position was requested. [0026], FIG. 5 (step 320); claims 1-2. If the device has moved, its current position is requested from its “position determinator,” and the device reports that position to the application requesting it. [0026], FIG. 5 (steps 330, 340); claims 1-2. If the device has not moved, its previously-reported position is reported to the application and the “position determinator” remains in a “low power consumption mode” because it is not needed to calculate the device’s current position. [0026]; FIG. 5 (step 350); claims 1-2; Braasch-Decl., ¶¶153-156.

⁵ Unless otherwise noted, Section VII.B.1’s citations are to Mantovani.

By not requesting position information from the position determinator when the device is stationary, “[u]nnecessary power consumed during the position information update is thereby eliminated.” [0012]; [0022]. To determine whether the electronic device has moved, Mantovani uses a “motion sensor,” *e.g.*, an “accelerometer.” [0024].

2. Cross-Mantovani Combination

POSAs had reasons to use Mantovani’s movement-based power-savings technique in Cross’s PNU.

First, Mantovani teaches that “[p]remature interruption of service due to complete battery discharge is a serious issue if,” like Cross’s battery-operated PNU, “the mobile device is used for security or safety purposes.” Mantovani, [0004]. Mantovani likewise teaches that “[r]educing power consumption in location enabled battery power devices,” like Cross’s PNU, “is useful for improving product usefulness,” *e.g.*, they last longer. *Id.*; [0013]; Braasch-Decl., ¶¶157-158. Mantovani thus explicitly motivates POSAs to use its power-savings technique in Cross’s PNU, to prevent “premature interruption of service” and “improv[e] product usefulness.” Braasch-Decl., ¶158.

Second, it would have been using a known technique (Mantovani’s power-savings technique) to improve similar devices (location-enabled battery-powered

mobile devices) in the same way (by optimizing power consumption based on movement). *KSR*, 550 U.S. at 417; Braasch-Decl., ¶159.

When Cross’s PNU is implemented in view of Mantovani, it would have included a conventional “motion sensor” like an “accelerometer.” Mantovani, [0024]. Using the accelerometer, Cross’s computer would detect whether the PNU is moving and request position information from the PNU’s GPS circuitry when the PNU has moved. Mantovani, [0026], FIG. 5; Braasch-Decl., ¶160. When the computer detects that the PNU has not moved, the PNU’s GPS circuitry enters a “low power consumption mode” and the PNU transmits its last calculated GPS coordinates until movement is detected. Mantovani, [0012], [0022], [0026], FIG. 5; Braasch-Decl., ¶160. Once movement is subsequently detected, the computer requests updated GPS coordinates from the GPS circuitry, causing it to exit the low-power consumption mode. Mantovani, [0012], [0022], [0026], FIG. 5; Braasch-Decl., ¶160.

POSAs would have had a reasonable expectation of success in making the Cross-Mantovani combination because Mantovani’s power-management technique applies to “any suitable mobile communication device including, but not limited to, a global positioning device,...a radio communication device, [or] a tracking device,” each of which performs functions similar to Cross’s PNU. Mantovani, [0014]; Braasch-Decl., ¶161. It would have required only ordinary skill for POSAs to add

to Cross's PNU (1) a conventional motion detector (*e.g.*, Mantovani's accelerometer) to (2) implement Mantovani's power-management technique (*e.g.*, a software algorithm) because motion detectors were small and low-power and the PNU already included GPS and a "computer" for executing device-functionality like Mantovani's power-management method. Cross, [032]; Mantovani, [0015]-[0016]; Braasch-Decl., ¶161.

3. Claim 2: The system of claim 1, wherein the personal alert device is operable to implement a power management scheme for optimizing power consumption in the personal alert device.

Like Mantovani, the '595 patent explains that optimizing "power consumption" of a personal alert device is achieved by using power-savings modes wherein the devices enter a low-function state, *e.g.*, "less frequent polling" occurs, or is turned off. EX1001, 5:53-6:5.

In Cross-Mantovani, Cross's PNU implements Mantovani's power-management technique to optimize its power consumption. For example, in Cross-Mantovani, the PNU's GPS circuit (and thus the PNU itself) (Cross, [041]) enters a "low power consumption mode" when the PNU's computer does not request position information from the GPS circuit for a particular period of time, *e.g.*, because the PNU is not moving (Mantovani, [0022]). Braasch-Decl., ¶¶162-163. This "low power consumption mode" optimizes the PNU's power consumption by

“eliminating unnecessary position information requests.” Mantovani, [0013]; Braasch-Decl., ¶¶163-164.

4. **Claim 3: The system of claim 2, wherein the power management scheme comprises transitioning the personal alert device from a full operation mode to a power-saving mode, the power-saving mode comprising at least one of shut-down mode and low-function mode.**

When implemented to perform Mantovani’s power-management technique, the PNU’s GPS circuit (Cross, [041]) will function in its normal operating mode when the PNU’s computer (using an accelerometer) determines that the PNU is moving. Mantovani, [0024], [0026], FIG. 5 (steps 330, 340); Braasch-Decl., ¶165. And when the PNU’s computer determines that the PNU has stopped moving, it will cease requesting new position information from the GPS circuit, causing the circuit (and thus the PNU itself) to enter a “low power consumption mode.” Mantovani, [0022], [0026], FIG. 5 (step 350); Braasch-Decl., ¶¶165-166.

5. **Claim 4: The system of claim 2, wherein the personal alert device comprises at least one control component for generating control data applicable to the power management scheme.**

In Cross-Mantovani, the PNU includes a motion sensor, *e.g.*, an accelerometer, which is “*a control component*,” as claimed. Braasch-Decl., ¶167; *see infra* §VII.B.6 (claim 5). The motion sensor (accelerometer) generates data that “set[s] or clear[s]” a “motion detection flag” that Cross-Mantovani PNU’s computer uses “to determine whether to request device position from” the PNU’s GPS

circuitry. Mantovani, [0024]; Braasch-Decl., ¶167. The data generated to set/clear the “motion detection flag” is “*control data*” that is “*applicable to* [Cross-Mantovani’s] *power-management scheme*” because the flag determines whether the PNU’s computer will request position information from the GPS circuitry or remain in a low-power mode. Braasch-Decl., ¶¶167-168.

6. Claim 5: The system of claim 4, wherein the at least one control component comprises a movement sensor for sensing movement of the worker, configured to generate indications when the personal alert device is moving or not.

In Cross-Mantovani, the PNU’s control component includes a movement sensor (*e.g.*, an accelerometer and associated circuitry), which detects whether the PNU (and thus the worker wearing it) is moving and “set[s]” or “clear[s]” a “motion detection flag” that indicates to the PNU’s computers whether the worker-worn PNU is moving or not. Mantovani, [0024]; Braasch-Decl., ¶¶169-170.

C. Ground 1C: Claim 6: Obvious Over Cross and Cyzs

1. Cyzs (EX1010)

Cyzs teaches that “[s]patial diversity is a well-known method for increasing the capacity and reliability of wireless links.” Cyzs, [0003]. With spatial diversity, “a wireless receiver is equipped with multiple antennas” so that “signals received by the different antennas vary due to environmental conditions.” *Id.* “The receiver takes advantages of these differences” to “increase[e] the effective rate at which the

receiver is able to receive data.” *Id.* A “[t]ransmitter may be equipped with redundant antennas for the same reasons,” *i.e.*, increase data-transmission rates. *Id.*

One spatial-diversity technique is “[p]olarization diversity,” in which the polarity of multiple antennas (*i.e.*, the direction in which their electromagnetic signals are sent) is set different from one another. Cyzs, [0005]; Braasch-Decl., ¶¶171-174. Other spatial-diversity techniques wherein antennas used the same polarity were also known. Cyzs, [0004], [0006]; Braasch-Decl., ¶175.

2. Cross-Cyzs Combination

POSAs had reasons to implement in Cross’s PNU spatial-diversity antenna techniques, which, as Cyzs teaches, were well-known in the art.

First, POSAs would have been motivated by Cyzs’s teaching that spatial-diversity techniques were “well-known” to “compensate for degradation” in wireless communications. Cyzs, [0003]; Braasch-Decl., ¶¶176-177. Reducing signal degradation in Cross would have improved its safety system by “increasing the effective rate at which” the PNU can receive/transmit data. Cyzs, [0003]; Braasch-Decl., ¶177.

Second, it would have been using known antenna-diversity techniques to improve similar devices (wireless-communication devices) in the same way (using conventional diversity antennas and processing to overcome degradation). *KSR*, 550 U.S. at 417; Braasch-Decl., ¶178.

In the Cross-Cyzs combination, Cross's PNU has multiple antennas to implement conventional signal-diversity techniques. POSAs would have reasonably expected success, using ordinary skill, in using multiple antennas in PNUs because by the early-2010s it was conventional to include in wireless, portable devices (1) multiple antennas having either identical or different polarizations and (2) conventional spatial-diversity algorithms to process signals transmitted by and/or received from multiple antennas. Cyzs, [0004]-[0006]; Braasch-Decl., ¶179 (citing EX1026, [0001]).

3. **Claim 6: The system of claim 1, wherein the one or more antennas comprise diversity antennas of identical or differing polarity, and the personal alert device is operable to support use of diversity during the transmitting and/or receiving of wireless signals.**

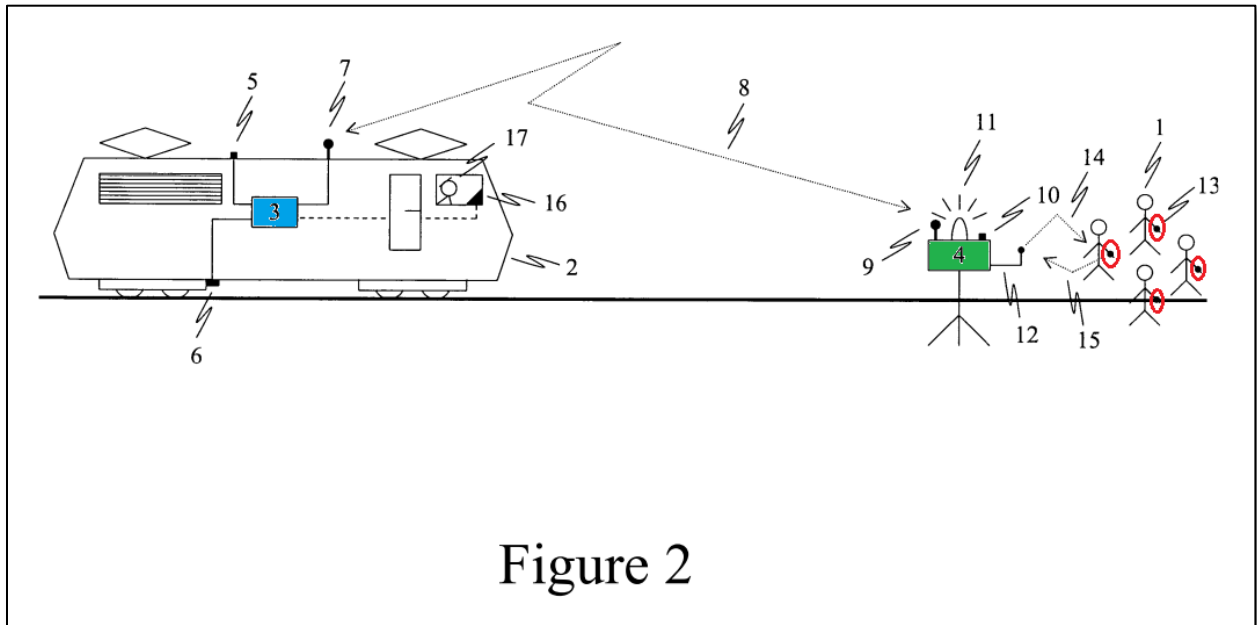
The '595 patent describes "diversity antennas" as antennas that use diversity "optimization techniques," *i.e.*, spatial-diversity techniques. EX1001, 8:55-58; Braasch-Decl., ¶180.

Cross-Cyzs's PNU has multiple antennas to support using "spatial diversity" for receiving/transmitting wireless signals. Cyzs, [0003]-[0005]. The PNU's antennas are "diversity antennas." Braasch-Decl., ¶180. Moreover, the PNU's diversity antennas would have either identical or different polarity because those were the two conventional options for diversity antennas to implement spatial-diversity techniques. Cyzs, [0003]-[0005]; Braasch-Decl., ¶¶180-181.

D. Ground 1D: Claims 16-17, 26: Obvious Over Cross and Meyer

1. Meyer (EX1012)⁶

Meyer discloses “a railway collision warning system.” Meyer, [0001], FIGS. 1-2. Similar to Cross (and the ’595 patent), Meyer’s system relies on three devices annotated in Meyer’s Figure 2 below: (1) a train-mounted “stationary unit” (blue), (2) a wayside-located “mobile or portable unit” (green) placed near a “construction site,” and (3) “mobile or portable transponders” (red) “arranged on or attached to the personnel to be warned.” *Id.*, [0017]-[0023].



The wayside units detect the presence of an approaching train, via wireless communication with the train, and wirelessly transmit a “warning signal” to the

⁶ EX1012 is a certified translation of Meyer’s German text. EX1013 (Exhibit B).

worker-worn transponders which in turn generate audio, physical, or visual alerts to the workers. *Id.*, [0023]; Braasch-Decl., ¶¶182-187.

Meyer teaches it is “exceedingly advantageous” for the worker-worn transponder to have “an actuation element, such as a pushbutton” the worker can press to acknowledge receipt of the transponder’s warning alert. Meyer, [0024]. “[A]ctuating” the actuation element causes the worker-worn transponder to “transmit[] a near range acknowledgement signal” that the wayside unit receives. *Id.*; [0042], claim 9. The wayside unit “compare[s] the number of transponders that have acknowledged the collision warning with a predetermined number of personnel exposed to a collision risk.” *Id.*, [0025]-[0026]. Based on that comparison, the wayside unit transmits a “collision status signal” to the train and if that signal “indicates that not all personnel have acknowledged the collision warning,” the train may be “automatically slowed down to avoid a collision.” *Id.*, [0027]-[0028]; *see also id.*, [0038]-[0046], claims 10-14; Braasch-Decl., ¶¶188-189.

2. Cross-Meyer Combination

POSAs had reason to include in Cross’s system Meyer’s teachings to (1) have workers acknowledge warnings of potential collisions, (2) send such acknowledgments directly to an approaching train, and (3) have the train compare the number of acknowledgments it receives to the predetermined number of workers exposed to a collision risk.

First, Meyer motivates the combination by teaching that it is “exceedingly *advantageous*” for personnel to acknowledge warnings and transmit acknowledgements to other devices in the system. Meyer, [0024], [0027]-[0028]. Meyer discloses that acknowledgement signals enable confirming that personnel have received a warning and “can clear the hazard zone.” Meyer, [0025]-[0026], [0038]-[0039]. By receiving the acknowledgements, rail-bound vehicles can determine the risk of collision and “initiate appropriate measures” (*e.g.*, “automatically slow down”). Meyer, [0043]-[0045]; Braasch-Decl., ¶¶190-191.

Second, it would have been using a known technique (Meyer’s acknowledgements) to improve similar devices (Cross’s and Meyer’s similar worker-safety systems) in the same way (to increase safety by using workers’ acknowledgments of warnings to confirm and/or make safety decisions). Braasch-Decl., ¶192.

In the Cross-Meyer combination, Cross’s PNU includes an actuator “pushbutton” (Meyer, [0024], [0042]), which workers use to transmit acknowledgement signals to Cross’s wayside priority detectors in response to receiving alert-triggering signals (*supra* §§VII.A.2.i-VII.A.2.j) (limitations [1H1]-[1H2])), just like Meyer’s transponders transmit acknowledgments to wayside units (Meyer, [0024], [0042]). Cross’s PNUs also communicate directly with VCUs on approaching vehicles (*e.g.*, Cross, [046]). Thus, POSAs also had reason for PNUs

to transmit acknowledgments directly to VCUs, so the VCUs did not have to wait for the wayside priority detectors to forward the acknowledgement(s) when the VCU was itself within communication range of the PNUs and for redundancy, *e.g.*, in case a wayside priority detector was inoperable. Braasch-Decl., ¶193.

VCUs receiving acknowledgements (either directly from PNUs or indirectly from priority detectors) would then execute Meyer's technique to (1) determine whether all personnel had acknowledged warning signals and (2) take "appropriate measures," *e.g.*, display acknowledgements and warnings on the vehicle and/or automatically adjust vehicle speed. Meyer, [0043]-[0045]; Braasch-Decl., ¶194.

POSAs would have reasonably expected success in making the combination because Cross and Meyer disclose similar safety systems, and Cross's alert devices (VCUs, PNUs, and priority detectors) already communicate wirelessly. *Supra* §§VII.A.2.i, VII.A.13.d (limitations [1H1], [21C]). It required only ordinary skill to add, or adapt existing button(s) on Cross's PNU, to function as an acknowledgement button that causes the device to transmit acknowledgement signals to priority detectors and VCUs. Braasch-Decl., ¶195. It also required only ordinary skill to program the VCU's computer/processor to determine whether all expected personnel had acknowledged signals and display acknowledgements and warnings of potential collisions using VCU I/O components (*supra* §VII.A.13.f (limitation [21E])). Meyer, [0042]-[0044]; Braasch-Decl., ¶195.

3. **Claim 16: The system of claim 1, wherein the personal alert device comprises one or more acknowledgment components, configured for receiving input from the worker, to indicate acknowledgment of the safety alert.**

In Cross-Meyer, the PNU includes an acknowledgement component (*e.g.*, “pushbutton”) configured “to receive a confirmation [acknowledgement] from the person to be warned” (*i.e.*, workers with the PNUs, *supra* §VII.A.2.d (limitation [1C])), which “*indicate[s] acknowledgement of the safety alert,*” as claimed. Meyer, [0024]-[0025], [0042]-[0043]; Braasch-Decl., ¶¶196-197.

4. **Claim 17: The system of claim 16, wherein the personal alert device is operable to communicate a signal to the companion alert device to indicate the acknowledgment of the safety alert by the worker.**

In Cross-Meyer, after the worker “has confirmed the warning signal,” the PNU “emits a short-range confirmation signal” to each companion alert device in the system, *i.e.*, Cross’s priority detector and its VCU. Meyer, [0024]; Braasch-Decl., ¶¶198-199; *supra* §VII.A.2.i (discussing limitation [1H1]).

5. **Claim 26**

- a. **[26A]: The system of claim 21, wherein the vehicle-mounted alert device is operable to: receive a signal indicating an acknowledgment of a safety alert by a worker in response to the broadcasted alert triggering signals**

In Cross-Meyer, the vehicle’s VCU is operable to receive acknowledgement signals from worker PNUs (directly and/or after forwarded from priority detectors)

so it could determine whether all relevant workers had acknowledged receiving the alert-triggering signals broadcast by the VCU (*e.g.*, AVL packets). *Supra* §VII.D.2 (discussing combination), §§VII.A.13.g-VII.A.13.h (limitations [21F1]-[21F2]). Thus, worker acknowledgements would have been received by the VCU in response to the broadcasted alert-triggering signals, as claimed. Braasch-Decl., ¶200.

b. [26B]: and provide, via the one or more I/O components, an indication of the acknowledgement to the operator of the vehicle.

In Meyer’s system, “the vehicle operator can be warned about a collision with the construction crew...when the collision status signal indicates that not all personnel have acknowledged the collision warning.” Meyer, [0028]. When this teaching is implemented in Cross-Meyer, the collision “warn[ing]” would have been communicated to the operator via the VCU’s I/O component, *i.e.*, its tablet computer, as that is the component in Cross-Meyer that provides outputs (audio, visual) to the operator and which permits the operator to provide inputs to the system so the operator can take “appropriate measures” (Meyer, [0044]). Braasch-Decl., ¶¶201-202.

E. Ground 1E: Claims 14 and 18: Obvious Over Cross and Cook

1. Cook (EX1014)

Cook discloses “[a] wireless power system” (Abstract) for “battery powered” devices ([0002]) that uses “inductive coupling” to “avoid[] wires, connectors or

contacts between the powering station and the device,” facilitating “hermetically sealed (waterproof) electronic devices” ([0042]). Braasch-Decl., ¶¶203-205.

2. Cross-Cook Combination

POSAs had reason to include in Cross’s PNU’s conventional wireless charging, as discussed in Cook.

First, POSAs would have been motivated by Cook’s teaching that wireless charging “avoid[ed] wires, connectors or contacts between the powering station and the device” and facilitated “hermetically seal[ing]” the device, making it “waterproof.” Cook, [0002]. POSAs would have recognized the benefits to Cross’s system in (1) avoiding the burden and cost of charging wires/cables (Cook, [0039]) and (2) hermetically sealing a safety device to make it more robust in wet and/or dirty environments (Cook, [0042]). Braasch-Decl., ¶¶206-207.

Second, it would have been using known techniques (inductive charging and hermetically-sealed electronic-device housings) to improve similar devices (wireless electronic devices) in the same way (removing the need for wires and protecting electronics from water/dust). *KSR*, 550 U.S. at 417; Braasch-Decl., ¶208.

In the Cross-Cook combination, the PNU (1) includes conventional inductive-charging components (*e.g.*, a matching circuit and resonant antenna, Cook, [0044], [0059]-[0060]) and (2) is hermetically sealed (Cook, [0042]). Braasch-Decl., ¶209. “PNU charging station[s],” where “individual PNUs...are recharged” (Cross,

[0053]), would be equipped with corresponding inductive-charging components. Braasch-Decl., ¶209. POSAs would have had a reasonable expectation of success because inductive charging and hermetically sealing were taught by Cook and were conventional technologies. Braasch-Decl., ¶210 (corroborating with EX1028, [0005]).

3. Claim 14: The system of claim 13, wherein the rechargeable power supply is operable to recharge without direct connection.

In Cross-Cook, the PNU’s rechargeable power supply (*supra* §VII.A.9 (claim 13)) is “*recharge[d] without direct connection*,” as claimed, via “inductive coupling” (Cook, [0042]). Braasch-Decl., ¶211.

4. Claim 18

a. [18A] The system of claim 1, wherein the housing completely seals internal space enclosing components of the personal alert device, and

In Cross-Cook, the PNU’s housing is “hermetically sealed (waterproof),” thereby completely sealing the internal space enclosing PNU components. Cook, [0042]; *see also* Cross, FIG. 2; Braasch-Decl., ¶212.

b. [18B] wherein charging the power supply and/or communication of data to and/or from the portable alert device is done without direct connection.

As *supra* §VII.E.3 (claim 14), the PNU’s power supply is charged without direct connection, *i.e.*, via inductive charging. Braasch-Decl., ¶213. Data is also

communicated wirelessly (*supra* §VII.A.2.f (claim [1E])), *i.e.*, without direction connection. Braasch-Decl., ¶¶213-214.

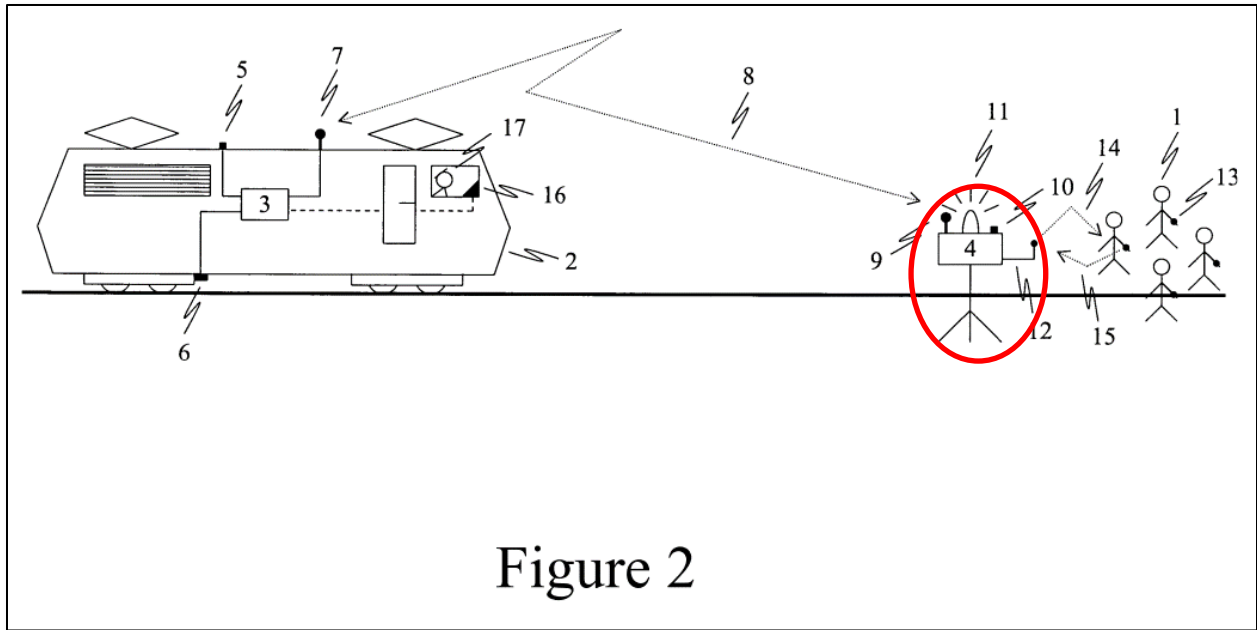
F. Ground 1F: Claims 27-30: Obvious Over Cross, Meyer and Welte

Claims 27-30 recite a worker-protection system that includes a “wayside detection unit” placed “on or near” a vehicle’s path and which (i) has “sensory components” that detect vehicles and (ii) broadcasts alert signals based on its detection of a vehicle. The ’595 patent identifies “sensory elements” as components that use “visual, infrared, laser ranging, etc.,” technologies to detect vehicles. EX1001, 14:17-23.

As shown below, implementing Cross’s priority detectors—*i.e.*, a “wayside detection unit,” as claimed—such that they (1) have a portable/mobile design that configures them for placement near a vehicle’s path, (2) include “sensory components” to detect vehicles, and (3) issue alerts related to such detection would have been obvious in view of Meyer and Welte.

1. Meyer

Meyer is described *supra* §VII.D.1. Relevant for Ground 1F, Meyer discloses a mobile wayside unit that can be located at various locations where workers are working and which communicates with worker-worn and train-mounted companion devices. Braasch-Decl., ¶217. The wayside unit includes an autonomous power source (Meyer, [0018]), and a tripod:



2. Welte (EX1016)

Welte discloses a “system for warning persons in a track building site of approaching trains.” Welte, Abstract. The system includes a “mobile” unit with a “sensor” that detects approaching vehicles. *Id.*, 4:14-16, 4:38-42. The vehicle-detecting sensor can be “an infrared or laser signal.” *Id.*, 4:54-55; *see also* 3:22-32, claim 6. When the mobile unit’s sensor detects an approaching train, the unit wirelessly transmits a “warning signal” to various “receiving units,” one of which is a worker-worn unit that vibrates, flashes light, or generates an acoustic signal. *Id.*, 1:14-37, 7:7-10, 7:27-40; Braasch-Decl., ¶¶218-219.

3. Cross-Meyer-Welte Combination

As discussed *supra* §VII.A.1 (Cross overview), Cross’s worker-protection system includes “priority detectors...generally located along a particular vehicle’s

route,” *e.g.* along a train’s track. Cross, [049]. Cross explains that “one common location for priority detectors [] will be at or in close proximity to intersections.” *Id.* As Cross’s Figure 1 illustrates, when priority detectors are located at an intersection, they utilize existing structures—*e.g.*, a signal pole and signal controller cabinet—to house their components. *Id.*; Braasch-Decl., ¶¶220-221.

Cross, however, does not explain how priority detectors are designed to operate in locations other than an intersection, *e.g.*, a worksite, despite Cross teaching that such detectors can be located “at various locations along a particular’s vehicles route” and listing intersections as merely exemplary locations. Cross, [049]. POSAs thus had reason to look to other prior-art wayside devices to determine how to implement Cross’s priority detectors when used at locations other than intersections. Braasch-Decl., ¶221.

Meyer teaches such an implementation. Specifically, Meyer teaches a mobile-wayside unit located along areas of a track where work is being performed. Meyer, FIGS. 1-2, [0012], [0019], [0035], [0039]. As Meyer explains, maintenance work is routinely performed on tracks, and there is a need to ensure worker safety at different worksites along the track. Meyer, [0012]. This common-sense recognition was well-known by 2015. Braasch-Decl., ¶222 (citing EX1029, 3:12-30).

In view of Meyer’s teaching (and the common-sense recognition) that workers should be protected when working at locations other than intersections, POSAs

would have had reason to implement Cross’s priority detectors using Meyer’s mobile-wayside unit. Braasch-Decl., ¶223. Beyond Meyer’s explicit motivation, the combination also would have been the routine use of one known technique (portable, wayside safety equipment) to improve similar devices (wayside devices operating in a railway system) in the same way (by making the device portable so that it could be placed wherever best suited to worker safety). *KSR*, 550 U.S. at 417; Braasch-Decl., ¶223.

Moreover, in view of Welte, POSAs would have had reason to augment Cross’s priority detector so that it included a laser or infrared sensor that detects an approaching train and broadcasts an alert signal when a train was detected. Using sensors to detect approaching trains would have added redundancy (and thus safety) to Cross’s system, *e.g.*, in addition to receiving AVL packets broadcast by Cross’s VCU (Cross, [049]), Welte’s teachings would have allowed priority detectors to independently detect an approaching vehicle, even if an AVL packet was not transmitted, not received, or corrupted. Braasch-Decl., ¶224.

In the Cross-Meyer-Welte combination, Cross’s priority detector would have the mobile design Meyer depicts (*e.g.*, Meyer, Figures 1-2), including an “autonomous power supply” (Meyer, [0018]) to power its components and a tripod to support the detector’s housing, so that the detector could be moved to different locations along a track, including locations without convenient access to the electric

grid or signaling equipment at an intersection. Braasch-Decl., ¶225; Welte, 6:36-67 (disclosing batteries in sensor unit and evaluating unit). The priority detector would otherwise maintain the same functionality (and corresponding hardware/software components) it had in Cross but would also be augmented to include a laser/infrared sensor, as Welte taught (*e.g.*, 4:54-55). In Cross-Meyer-Welte, if the laser/infrared sensor detects an approaching train, the priority detector would broadcast an alert signal to companion devices in the system, *e.g.*, Cross’s VCU’s and PNU’s, consistent with the teachings of both Welte and Meyer. *See, e.g.*, Welte, 7:7-10; Meyer, [0036] (describing “broadcast method” of signal transmission); Braasch-Decl., ¶225.

POSAs would have reasonably expected success in the Cross-Meyer-Welte combination because it would have required only ordinary skill to place Cross’s detector components (processor, transceiver, and antenna) in Meyer’s portable housing (*i.e.*, one with an autonomous power supply and using a tripod for support) and to use Welte’s sensory components for detecting the presence of approaching vehicles. Braasch-Decl., ¶226.

4. Claim 27

- a. [27PRE] A system for worker protection, the system comprises:**

Supra §VII.A.2.a (limitation [1PRE]). Braasch-Decl., ¶227.

- b. [27A] a wayside detection unit, configured for placement on or near path of a vehicle, the wayside detection unit comprising:

Cross-Meyer-Welte includes Cross's "priority detectors," which "are wayside devices" "located at various locations along a particular vehicle's route." Cross, [049], FIG. 1; Braasch-Decl., ¶228. In Cross-Meyer-Welte, the priority detectors use the portable housing Meyer depicts in Figure 2 (below). Braasch-Decl., ¶229.

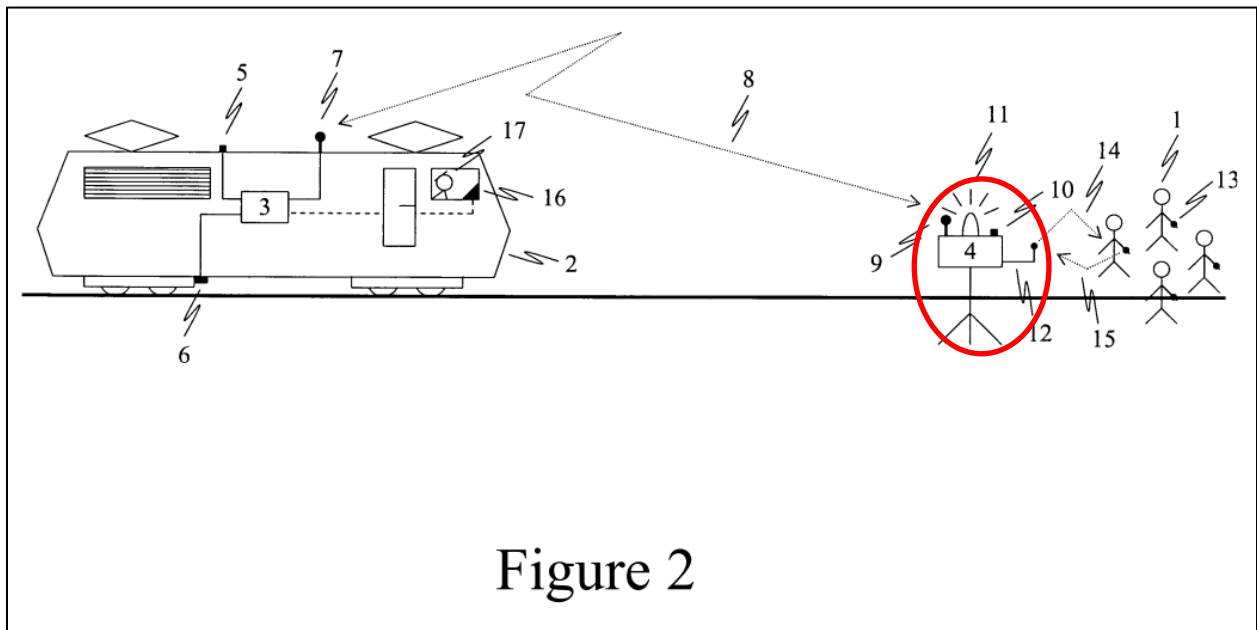


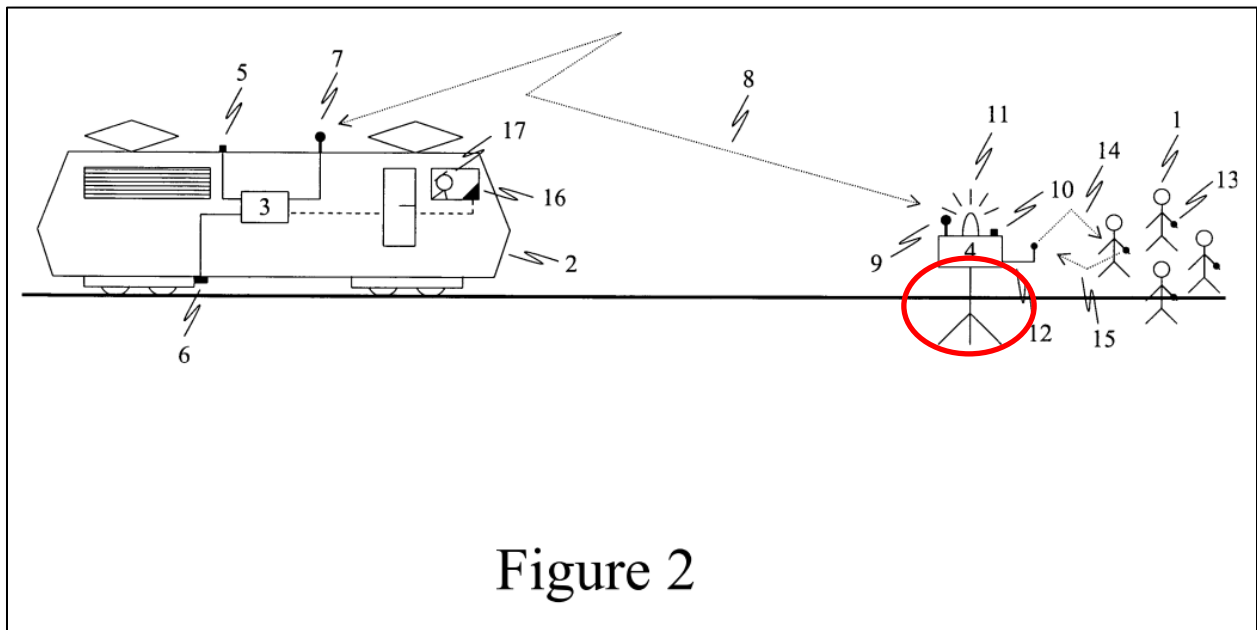
Figure 2

- c. [27B] a housing for enclosing components of the wayside detection unit;

The components of the Cross-Meyer-Welte's wayside priority detectors are housed in Meyer's housing. Meyer, [0018], [0040]; FIGS. 1-2; Braasch-Decl., ¶230.

- d. [27C] a support structure for holding and supporting the wayside detection unit when placed on or near the path;

Cross-Meyer-Welte's wayside priority detectors, implemented using Meyer's design, would have included Meyer's tripod support structure "*for holding and supporting the unit when placed on or near the path,*" as claimed. Meyer, FIGS. 1-2, [0035]-[0037], [0040]; Braasch-Decl., ¶231.



- e. [27D] a power supply for powering components of the wayside detection unit;

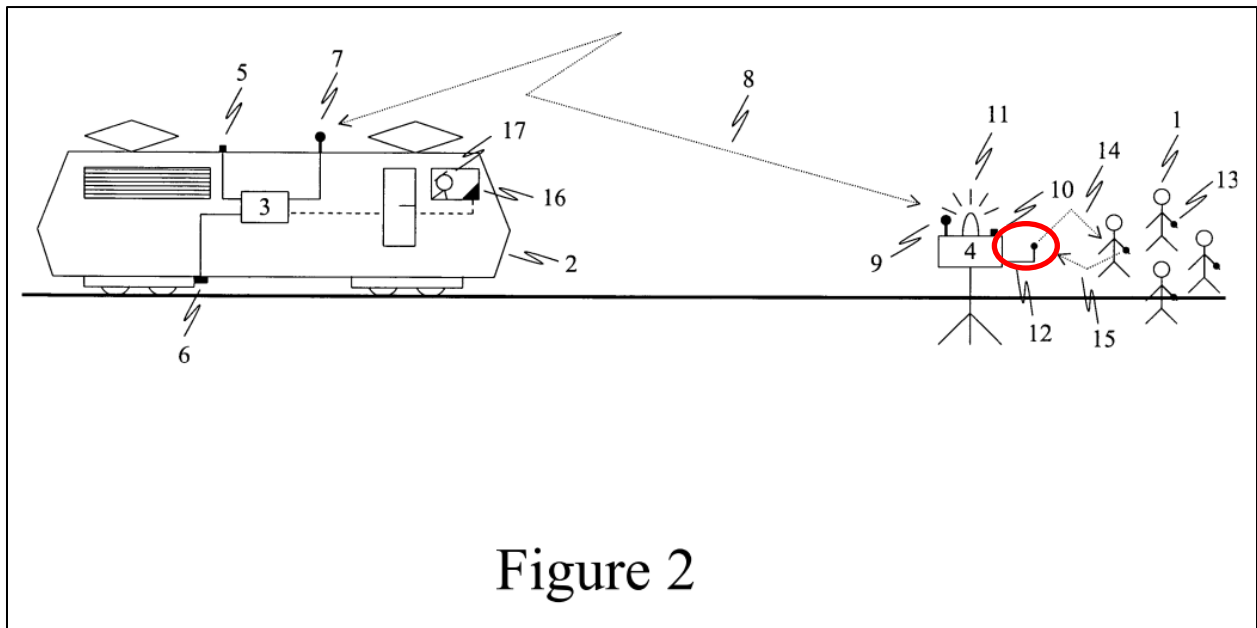
Cross-Meyer-Welte's wayside priority detectors use Meyer's "autonomous power supply," *e.g.*, batteries, to power their components. Meyer, [0018]; Braasch-Decl., ¶232.

- f. **[27E] one or more sensory components, for detecting, monitoring, and/or tracking vehicles;**

Cross-Meyer-Welte's wayside priority detectors use conventional sensory components such as a laser or infrared sensor (Welte, 4:54-55) to detect, monitor, and/or track vehicles. Braasch-Decl., ¶233.

- g. **[27F] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;**

Cross-Meyer-Welte's wayside priority detectors are "capable of receiving radio (RF) signals and forwarding the received data through the network" to companion devices like Cross's PNU's or VCU's. Cross, [049]. When Cross's priority detector is implemented using Meyer's portable design, it maintains the ability to receive/transmit wireless RF signals and uses an antenna like the one seen in Meyer's Figure 2 (below). Braasch-Decl., ¶¶234-235.



In Cross-Meyer-Welte, the wayside priority detector includes a communication component comprising an antenna (like the one Meyer depicts) along with related circuitry for processing wireless RF signals—together, a “*communication component*,” as claimed. Per Cross’s teachings, the Cross-Meyer-Welte detector would (1) “receiv[e]” wireless signals from components in the system such as a Cross’s VCUs, PNUs and other detectors, and (2) “forward[],” *i.e.*, transmit, wireless alert notification signals to those same components. Cross, [049]; Braasch-Decl., ¶236. Additionally, per Welte’s teachings, the Cross-Meyer-Welte detector would also transmit a wireless signal to nearby alert devices, like those worn by workers, when its laser/infrared sensor detects a train approaching. Welte, 4:14-23, 7:28-39; Braasch-Decl., ¶236.

h. [27G] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the wayside detection unit;

In Cross-Meyer-Welte, the portable priority detectors include electronic circuits operable to process received wireless signals (and the data they contain), like “real-time vehicle and worker activity and alert notifications,” and to transmit the signals (and associated data) to other components in the system. Cross, [049]; *see also* [031] (“receivers...encompass an electronic circuit”); Braasch-Decl., ¶237. These receiving and transmitting functions relate to operations of the wayside priority detectors. Braasch-Decl., ¶237.

Moreover, as discussed *supra* §VII.F.3 (combination overview), Cross-Meyer-Welte's detectors also include Welte's sensors for detecting the presence of approaching vehicles. Welte, 4:14-23, 7:28-39. In Welte, the sensor unit includes an "evaluating unit" that processes sensor signals to determine whether a train is approaching. Welte, 4:11-23, 6:49-7:20, FIG. 1. In Cross-Meyer-Welte, the portable priority detectors would include an electronic circuit(s) to perform the functionality that Welte's "evaluating unit performs" and thus process signals/data from the laser/infrared sensor to determine whether a vehicle is approaching and, if so, generate an alert for transmission to companion alert devices, like VCUs and PNUs. Braasch-Decl., ¶¶228-229. This additional functionality also relates to operations of the wayside priority detectors.

- i. **[27H1] wherein the wayside detection unit is operable to: determine, based on sensory data obtained from the one or more sensors, when the vehicle is approaching the wayside detection unit; and**

As discussed immediately above, Cross-Meyer-Welte wayside priority detectors are operable to use Welte's conventional sensor components and sensory data they generate to detect when a vehicle is approaching the unit. Welte, 4:38-55; Meyer, [0023]; Braasch-Decl., ¶240.

- j. **[27H2] broadcast, to one or more companion alert devices, alert related signals, relating to the approaching of the vehicle.**

In Cross-Meyer-Welte, the wayside priority detectors broadcast to PNU, VCU, and other wayside priority detectors (all companion alert devices) “*alert related signals, relating to the approaching of the vehicle,*” as claimed: because they broadcast signals to alert other devices that the wayside priority detector had determined a vehicle was approaching based on its laser/infrared sensor. Braasch-Decl., ¶241. As Meyer explains (and was understood at the time), broadcasting a signal ensured all devices capable of receiving the signal in a “certain radius” receive the signal. Meyer, [0036]. POSAs thus would have designed the Cross-Meyer-Welte wayside priority detector to broadcast its approaching-vehicle alert signal to all companion devices (*i.e.*, VCUs, PNUs, and other priority detectors) within its vicinity, to ensure that any nearby workers and vehicles knew of the approaching vehicle. Braasch-Decl., ¶¶241-242.

- 5. **Claim 28: The system of claim 27, wherein the wayside detection unit is operable to forward alerts and/or alert related signals communicated by one or more nearby alert devices, the one or more nearby alert devices comprises vehicle alert devices, personal alert devices and/or other wayside detection units.**

Cross-Meyer-Welte’s priority detectors “function as intermediaries..., receiving signals [communicated] from VCUs (103) and PNUs (102) and **forwarding** the real-time vehicle and worker activity and alert notifications[and

ETA information (*i.e.*, the alerts and alert-related signals discussed *supra* §VII.F.4.j (limitation [27H2]))...to...VCUs (103), or PNUUs (102),” which are nearby vehicle and personal alert devices, respectively, as claimed. Cross, [049]; *supra* §VII.A.13 (claim 21) (discussing VCUs), §VII.A.2 (claim 1) (discussing PNUUs); Braasch-Decl., ¶¶243-244.

6. Claim 29: The system of claim 27, wherein the wayside detection unit is operable to log data relating to alerts triggered in response to the broadcasted alert related signals.

Cross teaches “stor[ing] detailed activity and alert logs” in its PNUUs ([041]) and in its VCUs ([034]). POSAs would have had reason to include similar functionality in the Cross-Meyer-Welte’s wayside priority detectors to log data regarding the alerts the priority detector broadcasts once its laser/infrared sensor determines a vehicle is approaching. Braasch-Decl., ¶245.

Once Cross’s priority detectors were modified based on Meyer and Welte to include the ability to generate their own alert signals—*i.e.*, in response to detecting a vehicle approaching—POSAs would have recognized the benefits to giving the priority detectors the same ability to store logs that the PNUUs and VCUs already had in Cross’s system. Braasch-Decl., ¶246. As Cross teaches and was known in the art, such logs beneficially “allow[] for administrators to evaluate trends and identify reoccurring safety issues and locations in the mass transit system as a whole.” Cross, [063]; Braasch-Decl., ¶246.

Logging data relating to the operations of the wayside device would have also been using a known technique (logging operations of wayside devices in a traffic system) to improve similar devices (wayside devices in the system) in the same way (by keeping records of operations and alerts for diagnostic and tracking purposes). *KSR*, 550 U.S. at 417; Braasch-Decl., ¶247.

POSAs would have reasonably expected success in logging data relating to alerts because Cross teaches logging data in portable PNU devices and it would have required only ordinary skill to include in priority detectors (1) instructions/code to record alerts in a data log and (2) memory for the log. Braasch-Decl., ¶¶248-249.

7. Claim 30: The system of claim 27, wherein the support structure comprises a tripod or a connection element for permanent connection to wayside equipment.

As discussed *supra* §§VII.F.4.d-VII.F.4.e (limitations [27C]-[27D]), Cross-Meyer-Welte's priority detector uses Meyer's portable housing, which includes a tripod support structure, as claimed. Meyer, FIGS. 1-2 (annotated below). Braasch-Decl., ¶¶250-251.

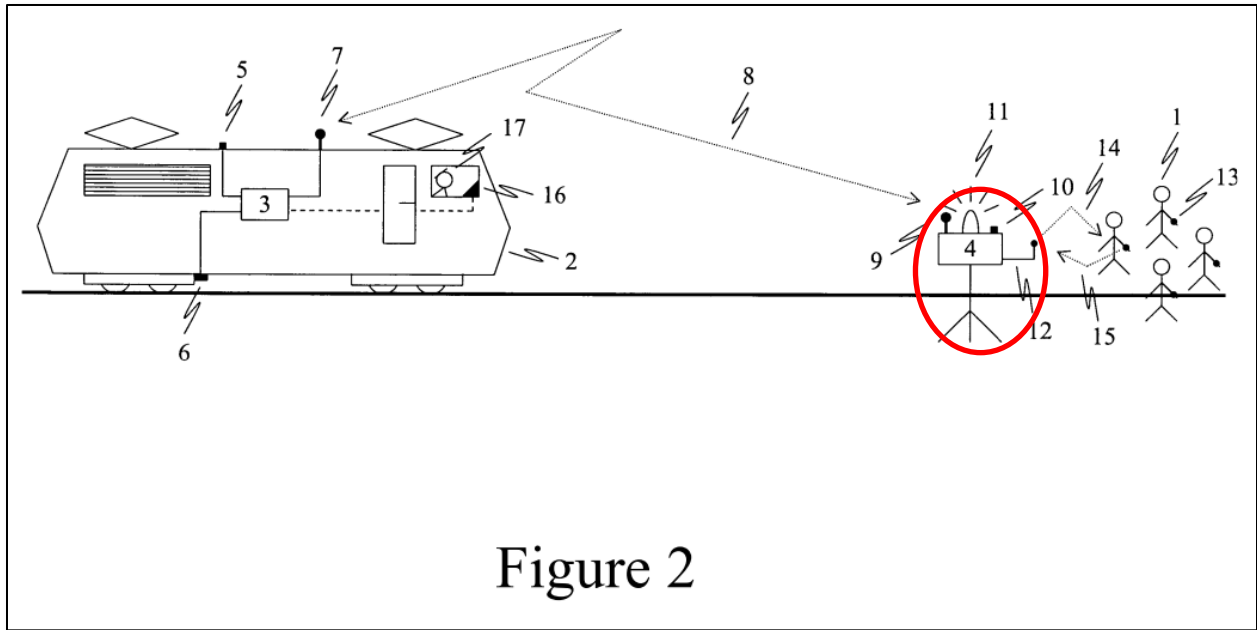


Figure 2

G. Ground 2: Claims 21-25: Anticipated by Carlson

1. Carlson (EX1006)⁷

Carlson was cited during prosecution, but not against claims 21-25.

Carlson discloses “a collision avoidance system” that “monitor[s] the location of and separation distance(s) between rail line vehicles.” [0002], [0006]. Carlson uses vehicle-mounted modules (VMMs) “located in or on” trains. [0037].

Each VMM includes three components depicted in Figure 3 below: (1) a “control electronics module[] (CEM)” (blue), (2) a “transponder sensor module[] (TSM)” (green) and (3) a “user interface module[] (UIM)” (brown). [0037]. The

⁷ Unless otherwise noted, Section VII.G’s citations are to Carlson.



gang.” [0041]; FIG. 4 (illustrating system with CTUs integrated in VMMs).
Braasch-Decl., ¶¶253-254.

Figure 6 (below) “depicts a block diagram” of an exemplary VMM ([0043]).

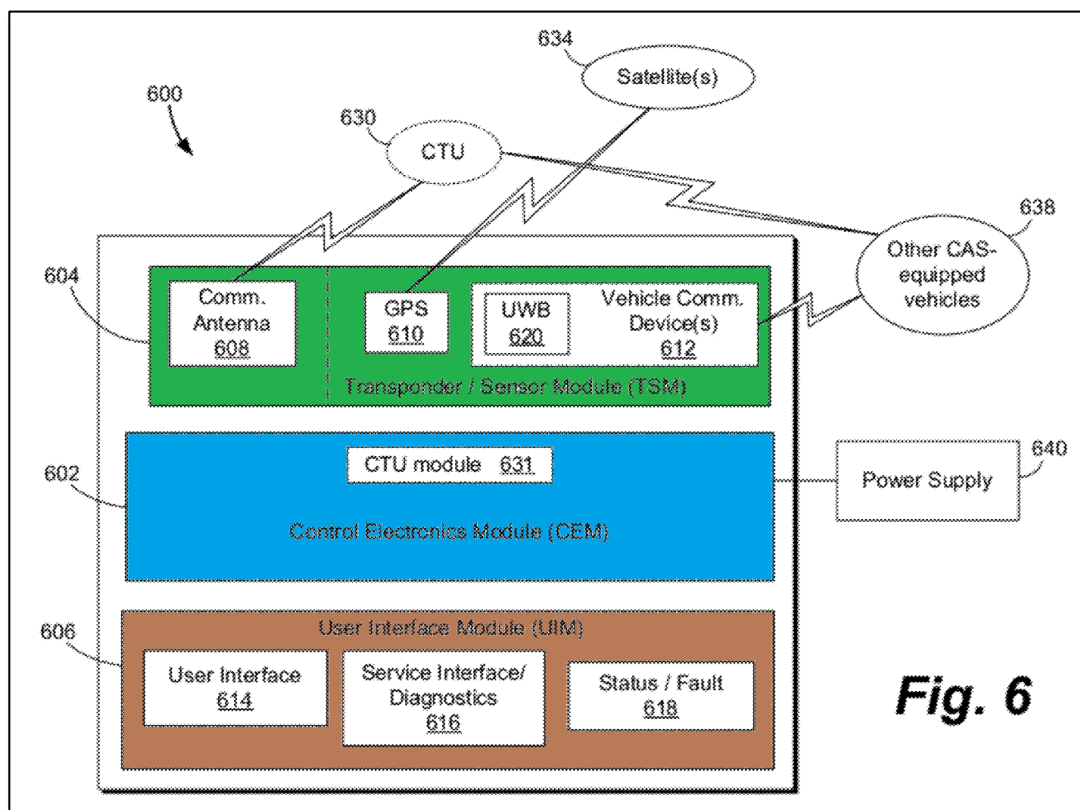
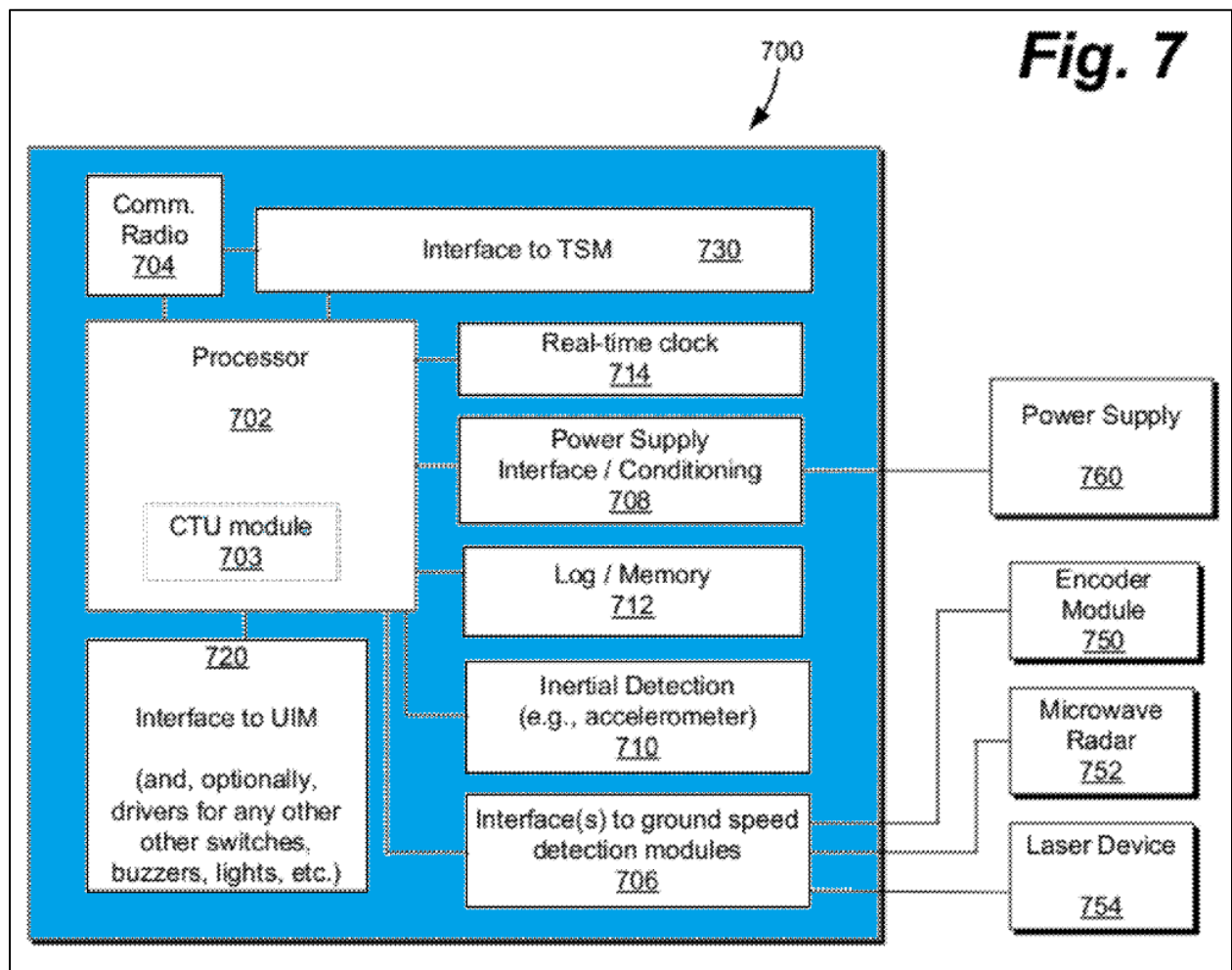


Fig. 6

The TSM (green) includes a “UWB unit,” which the VMM uses to communicate with UWB units on other VMM-equipped trains. [0043]-[0044], [0063]. Using UWB-signals, the UWB unit measures distance between itself and other UWB units and also transmits data to those other UWB units. [0063], [0066]; Braasch-Decl., ¶¶255-256.

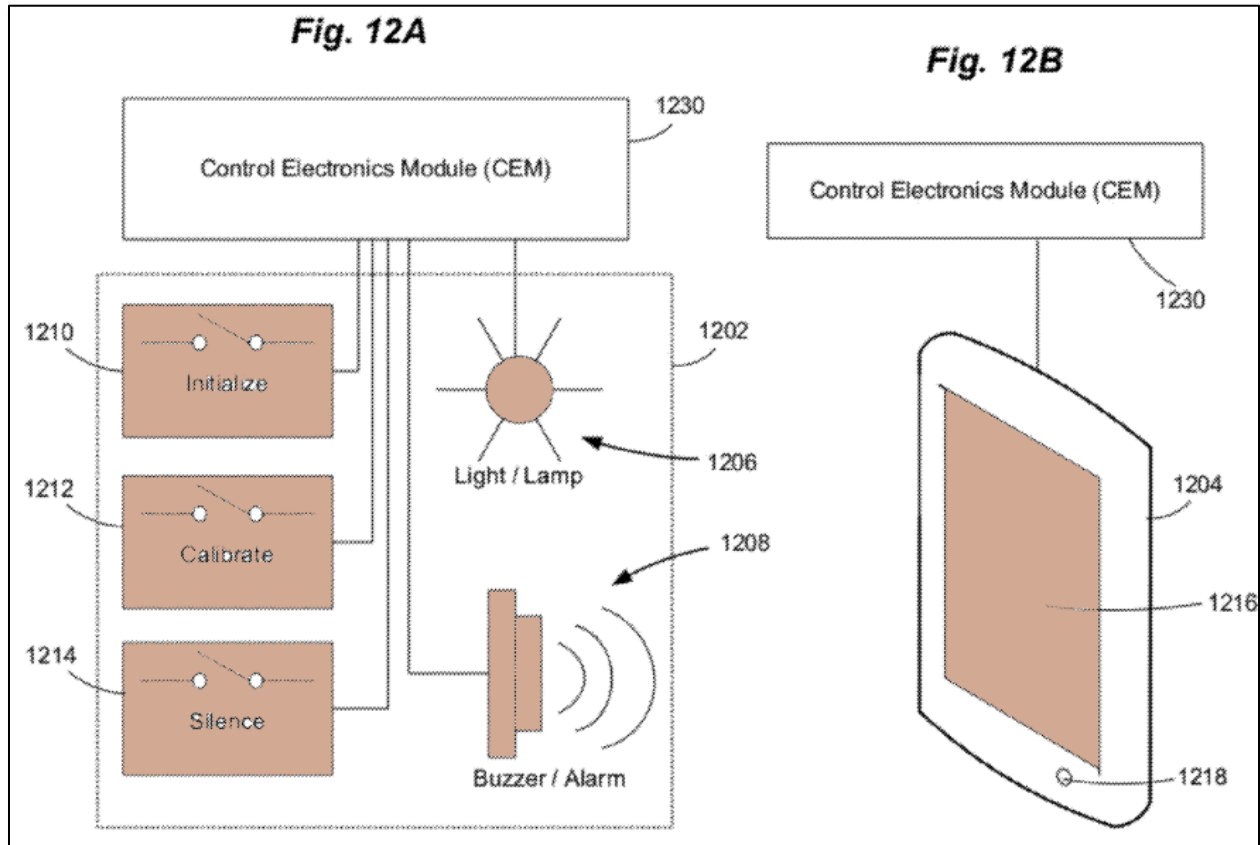
Figure 7 (below) depicts an exemplary CEM. [0047]. The CEM has a “processor” that executes the VMM’s “operations.” [0049]. In embodiments where

the CTU is integrated into the VMM as a CTU module (e.g., element 703 of Figure 7), the CTU's functionality, including "track[ing] vehicles...to determine when collisions may be imminent," is executed by the CEM's processor. [0049]. The CEM also includes "a log/memory" ([0047]) to log "warnings and alarms" the VMM experiences ([0120]). Braasch-Decl., ¶¶257-258.



The UIM includes a "user interface" like those in Figures 12A-12B. [0080]. Figure 12B's interface is a "touchscreen" that can have "physical buttons" or

“soft”/temporary buttons on the screen” and “one or more speakers and/or audio drivers” to “alert an operator to an event.” [0081]; Braasch-Decl., ¶259.



To detect potential collisions, the VMM uses its communication device, *e.g.*, its UWB unit, to “search for/link with other vehicles” and then “continuously sense/calculate distances” between itself and the other vehicles. [0099]. The VMM uses the distance calculations to “calculate information,” including “safe distance violations.” [0100]. If such a violation is detected, the VMM uses its user interface to “notify the operator,” for example, by activating “warning indicators and/or audible buzzers, alarms and the like.” [0100].

The VMM also “monitor[s] worker presence...so that a worker...may be alerted if a worker is standing in an unsafe location” (*e.g.*, “on the tracks...as another vehicle approaches”). [0121]. To do so, the VMM communicates with a UWB device, *e.g.*, “attached to the worker’s badge.” [0121]. Braasch-Decl., ¶¶260-261.

2. Claim 21

As explained above, Carlson has two principal embodiments for its system: one with a discrete CTU and one in which the CTU’s functionality is integrated into the VMM’s CEM and executed by the CEM’s processor. Braasch-Decl., ¶262. For Ground 2, Petitioners rely on the latter embodiment, in which the CEM’s processor performs the CTU’s functionality. As shown below, this embodiment anticipates claims 21-25.

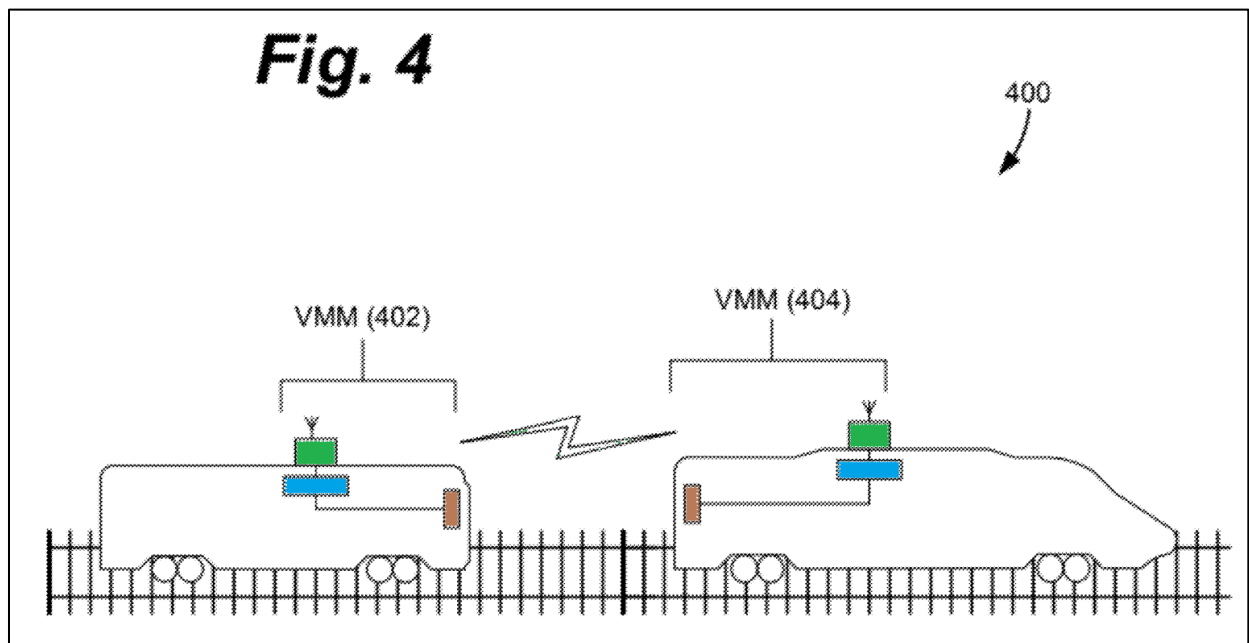
a. [21PRE] A system for worker protection comprises:

Carlson discloses “a collision avoidance system” that, *inter alia*, has “the ability to monitor worker presence around machines so that a worker or foreman may be alerted if a worker is standing in an unsafe location. [0121]-[0124]; Braasch-Decl., ¶263; *see also* [0003]-[0005] (explaining safety concerns present when railroad workers perform maintenance on tracks).

b. [21A] a vehicle-mounted alert device, configured for use on a vehicle

Carlson’s system includes a vehicle-mounted module (VMM) comprised of various “modules that are located in or on the vehicle (for example, TSM 306, CEM 310 and UIM 314).” [0003]; *see also* [0042]; FIGS. 3-4; Braasch-Decl., ¶264.

As seen in Figure 4, VMMs are “mounted on each vehicle.” [0042]:



See also [0046] (TSM’s “vehicle communication devices” are mounted on the “upper extremity of the vehicles”); [0056] (“TSM components (and/or other VMM components) may be installed on the upper extremity of a vehicle...”); claim 20 (“one or more [VMMs], each mounted on a vehicle”). Braasch-Decl., ¶265.

c. **[21B] the vehicle-mounted alert device comprising: a housing for enclosing components of the vehicle-mounted alert device;**

The VMM's components may "be housed within a unitary package/enclosure." [0037]; *see also* [0046] (explaining benefits to a single package). Alternatively, the components may be housed "within separate enclosures" with each component connected to a "main VMM enclosure." [0046]; [0084]; FIGS. 3-4. Either housing embodiment—*i.e.*, single enclosure for all components or multiple separate enclosures for each component—results in a VMM with "*a housing for enclosing components of the vehicle-mounted alert device,*" as claimed. Braasch-Decl., ¶266.

d. **[21C] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;**

The VMM's TSM [transponder-sensor module] has "vehicle communication devices" that "communicate wirelessly" with TSMs on other VMMs. [0062]. One such communication device is UWB unit 620 that includes "a UWB *antenna*." [0063]. Using its antenna, the UWB unit transmits/receives wireless signals. [0062] ("vehicle communication devices... include one or more integrated antennas for sending and receiving signals"); [0064]-[0067] (comparing UWB to "other wireless technologies"); FIGS. 3-4 & 10 (illustrating wireless communication via an antenna); claims 1, 20; Braasch-Decl., ¶267.

The VMM's TSM is thus a “*communication component*” with an antenna (UWB unit 620's antenna) “*for transmitting/receiving wireless signals*,” as claimed.

- e. **[21D] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the vehicle-mounted alert device; and**

The VMM includes circuits that process signals and perform applications/functions relating to the VMM.

For example, as explained *supra* §VII.A.13.d (limitation [21C]), the VMM includes a UWB unit that processes UWB-signals (and the data encoded therein) to calculate the distance between itself and other UWB units as well as transmit signals (and data) between itself and those units. [0063], [0066]; Braasch-Decl., ¶¶268-269. POSAs would understand that the UWB unit is a hardware component, and thus is a “circuit,” as broadly defined by the '595 patent. EX1001, 1:63-2:4; Braasch-Decl., ¶269. The UWB unit, *i.e.*, circuit, processes signals and data, *i.e.*, UWB signals (and the data transmitted in those signals), and performs one or more functions relating to operations of the VMM, *i.e.*, distance calculation, based on those signals/data. Braasch-Decl., ¶269.

The VMM also has a CEM with a “processor 702” that, “among other operations, process[es] information received from the vehicle communication devices,” such as UWB unit 620. [0049]; Braasch-Decl., ¶270. The CEM's “processor” is thus another circuit(s) operable to process signals and data, as

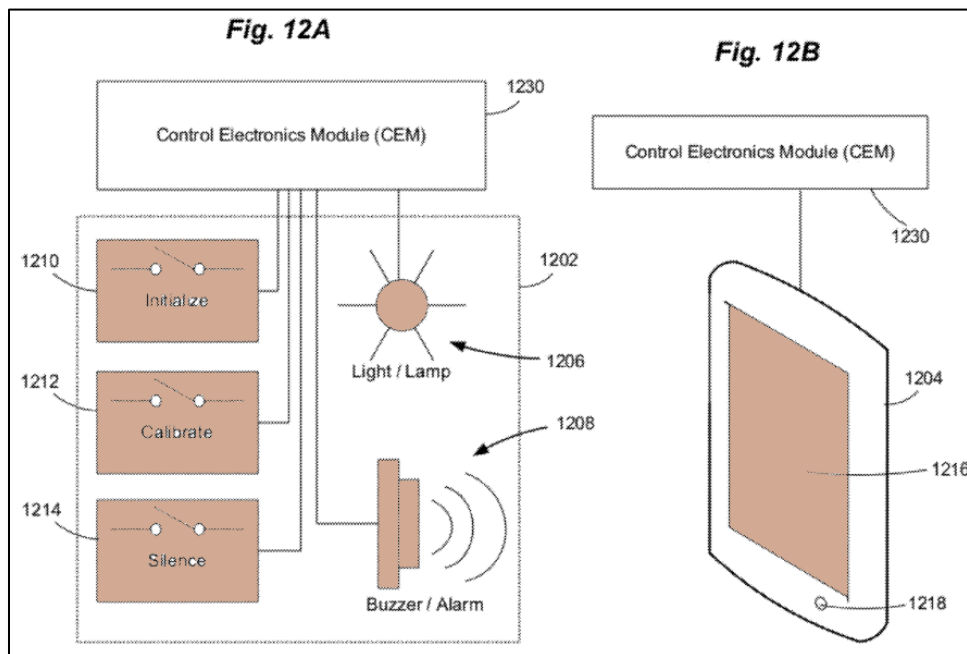
claimed. Braasch-Decl., ¶270. The CEM’s “processor” “handle[s] information and/or perform[s] computations to, among other things, track other vehicles in a work gang and determine which vehicles present a potential hazard.” [0049]; *see also* [0050]-[0051], [0060], [0086], [0103] (describing additional applications/functions of the VMM). The processor thus performs one or more applications/functions relating to operations of the VMM. Braasch-Decl., ¶270.

f. [21E] one or more input/output (I/O) components, for receiving input from an operator of the vehicle and/or for providing output to the operator of the vehicle;

The VMM’s UIM [user-interface module] has a “user interface” through “which the operator can engage with the technologies that are part of the VMM, and by which the operator may be alerted of events.” [0043], [0078], [0080]. The user interface “provide[s] a vehicle operator with information,” *i.e.*, “*provid[es] output to the operator,*” as claimed, “and may be operable to accept input from the vehicle operator,” *i.e.*, “*receiv[es] input from the operator,*” as claimed. Braasch-Decl., ¶271.

The user interface receives input from the operator and provides outputs to the operator using input/output (I/O) components. For example, Figure 12B (annotated below) depicts “a touchscreen” that “physical buttons” and “allow[s] the operator to engage ‘soft’/temporary buttons on the screen.” [0081]-[0082]. The touchscreen and/or its buttons are for receiving input from an operator of the vehicle.

The touchscreen's display and its “one or more speakers” ([0082]) are for providing output to the operator of the vehicle. [0031], [0078]-[0080], [0083]-[0084], [0111], [0116], claim 20; Braasch-Decl., ¶272.



- g. [21F1] wherein the vehicle-mounted alert device is operable to: broadcast alert triggering signals; and

The VMM's UWB unit “periodically transmit[s] short duration pulses,” *i.e.*, signals, to perform a distance measurement by measuring how long it takes a particular pulse to travel from the UWB unit to UWB units on different vehicles and/or workers. [0064]-[0065], [0069]-[0074] (describing UWB broadcast by VMM to “measure[...vehicle separation”), [0099]-[0100] (describing signals broadcast by VMM to “calculate...safe distance violations” and to discover “targets”); FIGS. 10-11, 15; Braasch-Decl., ¶273. Because the UWB pulses are

transmitted “in many directions” and sent to “UWB units” [plural], some of which may be unknown to the transmitting unit, POSAs would have understood that the UWB unit “broadcasts” its signals. [0063]-[0065], [0099] (describing transmissions used to “search” for multiple “hosts”); Braasch-Decl., ¶273; *supra* §VII.A.13.g (discussing broadcast). Alternatively, were Carlson found not to disclose “broadcast[ing]” of UWB signals, POSAs had reason to implement Carlson such that the VMM broadcast UWB signals for the same reasons discussed *supra* §VII.A.13.g. Moreover, “broadcasting” UWB-signals to perform distance ranging was also conventional by 2015 and codified as part of an IEEE standard at least by 2011. Braasch-Decl., ¶274.

In addition to distance separation determinations, the UWB signals are also broadcast to measure the “speed” of the vehicle to which the UWB unit is attached. [0065]-[0066], [0069], [0074]; Braasch-Decl., ¶273.

The UWB-generated distance and speed data are then processed to trigger alerts, as explained *infra* §§VII.A.13.h-VII.A.13.i (limitations [21F2]-[21F3]). Thus, the above-described broadcasted UWB signals are “*alert triggering signals*,” as claimed. Braasch-Decl., ¶275.

Additionally, the UWB unit’s broadcasted signals directly trigger alerts on nearby workers who are equipped with a UWB device. [0121]-[0122]; Braasch-

Decl., ¶276. The above-described broadcasted UWB signals are “*alert triggering signals*,” as claimed, for this reason too. Braasch-Decl., ¶276.

h. [21F2] generate, in response to triggering of alerts, data relating to alerts and/or to other devices or objects in path of the vehicle; and

Based on the distance and speed information that the UWB unit generates, the VMM “calculate[s],” *inter alia*, “absolute and relative location of the vehicles..., separation distances and/or safe distance violations” to “determine [whether] collision is imminent or prescribed safe distances are violated.” [0100]. *See also* [0039], [0041], [0045], FIG. 13 (step 1312). If collision is imminent or a safe distance is violated, then “one or more warning indicators and/or audible buzzers, alarms...will activate.” [0100], [0105], FIG. 13; Braasch-Decl., ¶277.

In response to activating (*i.e.*, triggering) these alerts, the VMM generates data related to the alerts and/or to devices or objects in the path of vehicle, as claimed. For example, the VMM generates data to trigger the VMM’s “warning indicators and/or audible buzzers.” [0105]-[0107], [0111]-[0113], [0116]-[0118]; claim 24; Braasch, ¶278. It also generates data to create a log of “[a]ll warning and alarms.” [0120]. And when the VMM determines a worker is “standing on the tracks near a vehicle,” the VMM generates data to activate the vehicle’s “emergency brake.” [0122]; Braasch-Decl., ¶278.

- i. **[21F3] output based on the data, via the one or more I/O components, feedback information to the operator.**

Based on the above-described generated data, the VMM outputs via its user interface I/O components (*supra* §279 (limitation 21E)) feedback information to the operator, as claimed. Feedback information includes audio/visual alarms (*e.g.*, “notifications,” *e.g.*, sounds and/or caution texts), event-log information, and/or adjustments to the vehicle’s speed on the display. [0104]-[0108], [0111]-[0114], [0120]-[0121]; Braasch-Decl., ¶¶279-280.

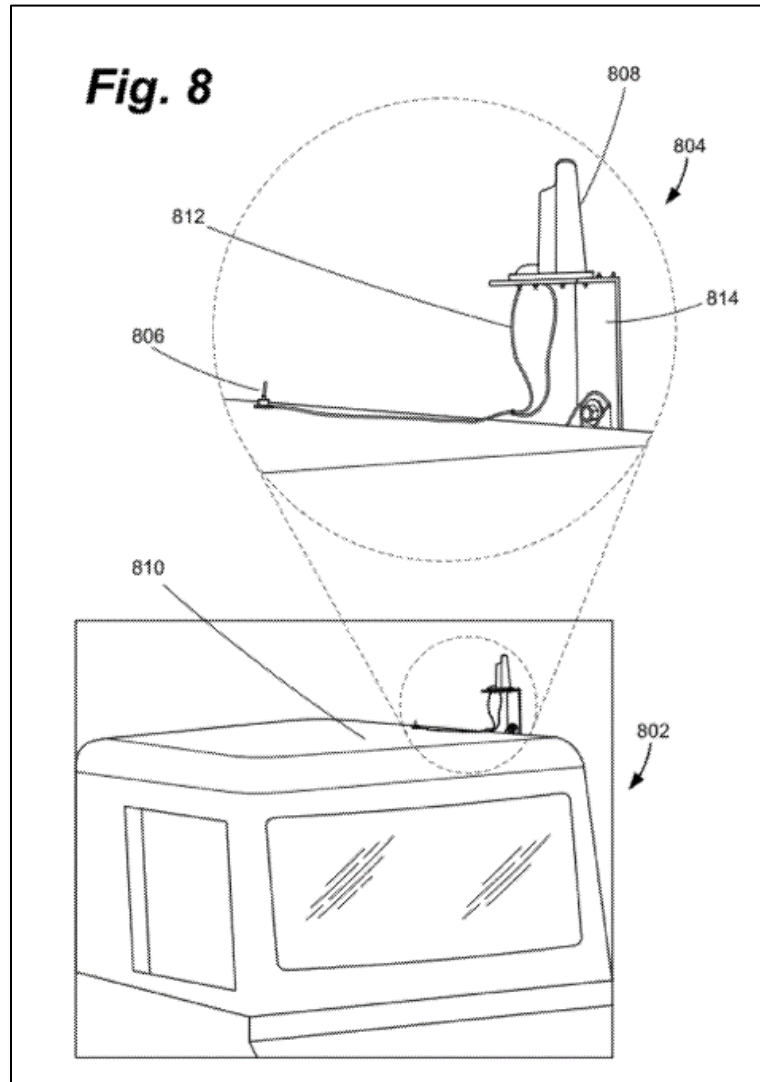
3. **Claim 22: The system of claim 21, wherein the vehicle-mounted alert device is configured, at least in part, as portable, detachable and movable from the vehicle.**

Carlson teaches the VMM, at least in part, may be portable, detachable, and moveable from the vehicle.

For example, the VMM’s user interface can be a “tablet” or “PDA” ([0081]), each of which POSAs would have understood is portable, detachable, and moveable from the vehicle. Reinforcing that understanding, Carlson teaches that the user interface can have a “wireless connection” with the VMM’s CEM [control electronics module]. [0085]; Braasch-Decl., ¶¶281-282.

Additionally, the VMM’s various TSM components, including its UWB unit, “may be installed on the upper extremity of a vehicle.” [0056]; *see also* [0046] (explaining “vehicle communication devices 612,” *i.e.*, UWB unit 620, “may be mounted separately...on the upper extremity of the vehicle”). As shown in Figure

8 (below), the UWB unit (element 808) is portable, detachable, and movable from the vehicle, *e.g.*, by unscrewing it from bracket 814. [0055]-[0056]; Braasch-Decl., ¶282.



4. **Claim 23: “The system of claim 21, wherein the vehicle-mounted alert device is operable to log data relating to alerts triggered in response to movement of the vehicle.”**

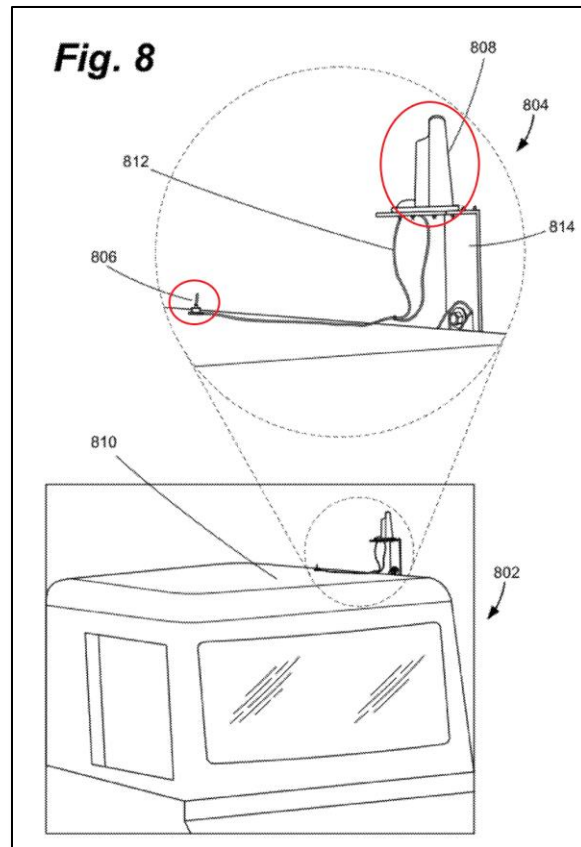
The VMM is operable to generate “logs of events that occur during the operation of the collision avoidance system,” like “warnings and alerts.” [0120],

[0128]. The warnings and alerts are triggered in response to movement of the vehicle (*e.g.*, when it moves to a location where a collision becomes imminent), as explained *supra* §§VII.A.13.e, VII.A.13.g-VII.A.13.i (limitations [21D], [21F1]-[21F3]). [0049], [0100], [0106]-[0108]; Braasch-Decl., ¶283.

5. **Claim 24: The system of claim 21, wherein the vehicle-mounted alert device is arranged into a plurality of separate physical units that comprises at least a broadcast unit comprising at least the communication component, the broadcast unit is configured to attachment external to the vehicle.**

As explained *supra* §VII.A.13.c, the VMM's components may be housed "within separate enclosures." [0046]; [0084]; FIGS. 3-4. Carlson teaches there are "benefits" to "packag[ing] one or more TSM components separately from other VMM components, for example on an upper extremity of a vehicle" and depicts such an implementation in Figure 8. [0054]-[0055]; *see also* [0037]; FIG. 3 (depicting TSM 306 on top of train); [0046]. In Figure 8's implementation, the TSM is disposed "on the roof of the vehicle," separate from the CEM which is "disposed below the roof of the vehicle," and the TSM's UWB unit is mounted to a bracket on the roof. [0052]-[0054].

In Figure 8's implementation (below), the TSM (*i.e.*, the physically-separate broadcast unit, as claimed), includes a UWB unit (the "*communication component*," as claimed) and the TSM is configured to attachment external to vehicle, as claimed. Braasch-Decl., ¶¶284-285.



6. **Claim 25: The system of claim 24, wherein the plurality of separate physical units comprises an operator unit comprising at least the one or more I/O components, the operator unit is configured for use by the operator.**

The VMM’s UIM “may be packaged separately” in its own physical unit, *e.g.*, a separate touchscreen or tablet. [0046], [0081]. As discussed *supra* §VII.A.13.f (limitation [21E]), the UIM is an operator unit that comprises I/O components (*e.g.*, touchscreen and buttons) configured for use by the operator, as claimed: for example, to “provide an operator with an interface by which the operator can engage with...the UIM” (*e.g.*, view displayed warnings, “activate and deactivate component

interface,” “send messages”). [0079]-[0083]; *see also id.*, [0108]-[0113]; Braasch-Decl., ¶286.

VIII. NO BASIS FOR DISCRETIONARY DENIAL

A. Section 314(a)

“[T]he PTAB will not deny institution based on *Fintiv* if there is compelling evidence of unpatentability,” which this Petition provides. Director’s Interim Procedure for Discretionary Denials (June 21, 2022) (“Interim Procedure”). That should conclude the *Fintiv* analysis here. Regardless, the *Fintiv* factors also weigh against discretionary denial.

1. Stay Potential

Without “specific evidence” how the court will rule regarding a stay, this factor is neutral. *Sand Revolution II v. Continental Intermodal Group–Trucking*, IPR2019-01393, Paper 24, 7 (June 16, 2020) (informative).

2. Trial Timing

Petitioners filed this Petition before the district court has ruled on Petitioners’ motions to dismiss and before any procedural schedule has been set. EX1034. This factor thus weighs against discretionary denial. *Samsung Elecs. v. Netlist, Inc.*, IPR2022-00063, Paper 13, 8 (May 5, 2022).

3. Litigation Investment

Other than initial motion practice, the parties have invested little in the litigation. This factor thus also weighs against discretionary denial. *Id.*

4. Issue Overlap

Given its early stage, the validity issues in the litigation are unknown. However, Petitioners challenge all 30 claims, whereas patent owner has asserted only two in the litigation. EX1035, pp. 85-89. The Board will thus address 28 claims that the district court will not address, weighing against discretionary denial. *Markforged Inc. v. Continuous Composites.*, IPR2022-00679, Paper 7 at 32-33 (Oct. 25, 2022).

5. Litigation Defendants

Although Petitioners are litigation defendants, the Board will reach a final decision before any district court trial thereby simplifying the litigations. *Samsung Elecs*, IPR2022-00063, Paper 13, 8.

6. Other Circumstances

The Petition's "strong showing on the merits" weighs against discretionary denial. Interim Procedure, 3-5.

B. Section 325(d)

Under *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geraete GmbH*, IPR2019-01469, Paper 6 (Feb. 13, 2020) (precedential), the Board considers

whether the Petition presents the same/substantially the same art/argument previously presented and, if so, whether it shows that the Office materially erred in its prior evaluation.

1. Step 1: The Petition Advances Art and Arguments Not Previously Considered

The six Cross-based grounds demonstrate the unpatentability of every claim based on art and arguments never presented to the Office. This is reason alone to find that Step 1 is not satisfied. *Allgenesis Biotherapeutics v. Cloudbreaker Therapeutics*, IPR2020-01438, Paper 7, 11-12 (Feb. 18, 2021) (Step 1 not satisfied where petition included ground(s) challenging all claims using previously-unconsidered prior art).

Though cited during prosecution, Carlson was only applied as a secondary reference in combination with Sheardown against dependent claims 9-10, 16-17 and 19. EX1002, 139-140. Here, the Petition neither relies on Carlson in combination with Sheardown, nor applies Carlson against claims 9-10, 16-17, and 19. The Petition's argument that Carlson anticipates claims 21-25 has thus not been considered previously by the Office. Accordingly, Step 1 is not satisfied even as to the Carlson-ground.

2. Step 2: The Office Erred Materially

If the Board finds Step 1 satisfied because Carlson was cited during prosecution, discretionary denial is still unwarranted because the Office erred

materially in its prior “evaluation.” Step 2 focuses on *Becton, Dickinson* factors (c), (e), and (f) (*Advanced Bionics*, 10), which all weigh against denial.

a. Factor (c): Carlson Was Not Evaluated Against Claims 21-25

During prosecution, Carlson was not asserted against independent claim 21 and dependent claims 22-25, and the Board has “consistently held that a reference that was neither applied against the claims nor discussed by the Examiner does not weigh in favor of exercising discretion under § 325(d).” *Bowtech, Inc. v. MCP IP, LLC*, IPR2019-00382, Paper 12, 12 (Aug. 6, 2019). Petitioners are not asking the Office to reconsider any arguments regarding claims 21-25; they are asking the Office to consider whether Carlson anticipates those claims for the first time. *Bowtech, Inc. v. MCP IP, LLC*, IPR2019-00383, Paper 14, 4 (Aug. 6, 2019) (finding persuasive that the previously-presented reference was applied against certain claims during prosecution but not against the challenged claims).

b. Factors (e)-(f): The Office Erred

Where “the Office’s previous consideration of the art is not well developed or silent, then a petitioner may show the Office erred by overlooking something persuasive.” *Advanced Bionics*, 10.

The Petition details how Carlson anticipates claims 21-25. This is “something persuasive” that the Office overlooked. Indeed, as explained *supra* §V.C, the examiner’s only non-final office action did not even appreciate that claims 21-25

were even pending. EX1002, 62 (“Claims 1-20 is/are pending...”), *id.*, 31 (noting examiner’s mistake). The Office thus apparently overlooked claims 21-25 ***entirely***.

IX. CONCLUSION

The Board should institute this IPR.

Dated: 01-09-2023

Petitioners,

By /Richard Giunta/

Richard F. Giunta, Reg. No. 36,149
WOLF, GREENFIELD & SACKS, P.C.

CERTIFICATE OF SERVICE UNDER 37 C.F.R. § 42.6 (E)(4)

I certify that on January 9, 2023, I will cause a copy of the foregoing document, including any exhibits or appendices filed therewith, to be served via Overnight FedEx at the following correspondence address of record for the patent:

McAndrews Held & Malloy, Ltd
500 West Madison Street
Suite 3400
Chicago, IL 60661

Date: January 9, 2023

/MacAulay Rush/
MacAulay Rush
Paralegal
WOLF, GREENFIELD & SACKS, P.C.

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that the foregoing IPR petition contains 13,995 words excluding a table of contents, a table of authorities, Mandatory Notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing. Petitioners have relied on the word count feature of the word processing system used to create this paper in making this certification.

Date: January 9, 2023

/MacAulay Rush/
MacAulay Rush
Paralegal
WOLF, GREENFIELD & SACKS, P.C.

X. CLAIM LISTING

The following claim listing assigns element labels (*e.g.*, [1A1], [1A2], etc.) to certain claims for clarity.

Claim 1
[1PRE] 1. A system for worker protection, the system comprises:
[1A] a compact wearable personal alert device, configured for use by a worker,
[1B] the personal alert device comprising: a housing for enclosing components of the personal alert device;
[1C] an attachment structure for attaching the personal alert device to the worker or an item used by the worker;
[1D] a power supply for powering components of the personal alert device;
[1E] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;
[1F] one or more indicator components, for outputting alert indications; and
[1G] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the personal alert device;
[1H1] wherein the personal alert device is operable to: process signals received from a companion alert device, wherein the companion alert device is deployed locally in proximity of the personal alert device and/or within vehicles operating in areas service by workers;
[1H2] generate, in response to signals received from the companion alert device, a safety alert; and
[1H3] output, via the one or more indicator components, one or more alert indications to the worker based on the safety alert.
Claim 2
2. The system of claim 1, wherein the personal alert device is operable to implement a power management scheme for optimizing power consumption in the personal alert device.
Claim 3
3. The system of claim 2, wherein the power management scheme comprises transitioning the personal alert device from a full operation mode to a power-saving mode, the power-saving mode comprising at least one of shut-down mode and low-function mode.
Claim 4

4. The system of claim 2, wherein the personal alert device comprises at least one control component for generating control data applicable to the power management scheme.
Claim 5
5. The system of claim 4, wherein the at least one control component comprises a movement sensor for sensing movement of the worker, configured to generate indications when the personal alert device is moving or not.
Claim 6
6. The system of claim 1, wherein the one or more antennas comprise diversity antennas of identical or differing polarity, and the personal alert device is operable to support use of diversity during the transmitting and/or receiving of wireless signals.
Claim 7
7. The system of claim 1, wherein triggering of alerts and/or broadcast of signals triggering of the alerts is based on one or more types of alert thresholds.
Claim 8
8. The system of claim 7, where the one or more types of alert thresholds comprise time-to-arrival (TTA), distance-from-train (DFT), and low-speed close proximity distance alert (CPD).
Claim 9
9. The system of claim 1, wherein the personal alert device is operable to communicate with one or more nearby alert devices, to forward received signals and/or alerts generated in response to the received signals among the personal alert device and the one or more nearby alert devices.
Claim 10
10. The system of claim 1, wherein the personal alert device is operable to log data relating to alerts triggered and/or handled by the personal alert device.
Claim 11
11. The system of claim 1, wherein the companion alert device comprises a vehicle-mounted alert device, a wayside detection unit, or another personal alert device.
Claim 12
12. The system of claim 1, wherein the one or more indicator components comprise at least one of visual indicator, audio indicator, and a tactile indicator.
Claim 13
13. The system of claim 1, wherein the power supply comprises a rechargeable power supply.
Claim 14

14. The system of claim 13, wherein the rechargeable power supply is operable to recharge without direct connection.
Claim 15
15. The system of claim 1, wherein the attachment structure comprises a clip structure or a strap structure.
Claim 16
16. The system of claim 1, wherein the personal alert device comprises one or more acknowledgment components, configured for receiving input from the worker, to indicate acknowledgment of the safety alert.
Claim 17
17. The system of claim 16, wherein the personal alert device is operable to communicate a signal to the companion alert device to indicate the acknowledgment of the safety alert by the worker.
Claim 18
[18A] 18. The system of claim 1, wherein the housing completely seals internal space enclosing components of the personal alert device, and
[18B] wherein charging the power supply and/or communication of data to and/or from the portable alert device is done without direct connection.
Claim 19
19. The system of claim 1, wherein the personal alert device is operable to implement configurable alarm management for allowing setting and/or adjusting of rules controlling triggering and/or handling of alerts.
Claim 20
[20A] 20. The system of claim 1, wherein the personal alert device is operable to: receive Global Navigation Satellite System (GNSS) signals;
[20B] determine location information based on the received GNSS signals; and
[20C] utilize the location information in conjunction with at least one of the operations of the personal alert device.
Claim 21
[21PRE] A system for worker protection comprises:
[21A] a vehicle-mounted alert device, configured for use on a vehicle,
[21B] the vehicle-mounted alert device comprising: a housing for enclosing components of the vehicle-mounted alert device;
[21C] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;
[21D] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the vehicle-mounted alert device; and

[21E] one or more input/output (I/O) components, for receiving input from an operator of the vehicle and/or for providing output to the operator of the vehicle;
[21F1] wherein the vehicle-mounted alert device is operable to: broadcast alert triggering signals; and
[21F2] generate, in response to triggering of alerts, data relating to alerts and/or to other devices or objects in path of the vehicle ; and
[21F3] output based on the data, via the one or more I/O components, feedback information to the operator.
Claim 22
22. The system of claim 21, wherein the vehicle-mounted alert device is configured, at least in part, as portable, detachable and movable from the vehicle.
Claim 23
23. The system of claim 21, wherein the vehicle-mounted alert device is operable to log data relating to alerts triggered in response to movement of the vehicle.
Claim 24
24. The system of claim 21, wherein the vehicle-mounted alert device is arranged into a plurality of separate physical units that comprises at least a broadcast unit comprising at least the communication component, the broadcast unit is configured to attachment external to the vehicle.
Claim 25
25. The system of claim 24, wherein the plurality of separate physical units comprises an operator unit comprising at least the one or more I/O components, the operator unit is configured for use by the operator.
Claim 26
[26A] 26. The system of claim 21, wherein the vehicle-mounted alert device is operable to: receive a signal indicating an acknowledgment of a safety alert by a worker in response to the broadcasted alert triggering signals; and
[26B] provide, via the one or more I/O components, an indication of the acknowledgement to the operator of the vehicle.
Claim 27
[27PRE] 27. A system for worker protection, the system comprises:
[27A] a wayside detection unit, configured for placement on or near path of a vehicle, the wayside detection unit comprising:
[27B] a housing for enclosing components of the wayside detection unit;
[27C] a support structure for holding and supporting the wayside detection unit when placed on or near the path;
[27D] a power supply for powering components of the wayside detection unit;
[27E] one or more sensory components, for detecting, monitoring, and/or tracking vehicles;

[27F] a communication component, comprising one or more antennas, configured for transmitting and/or receiving wireless signals;
[27G] one or more circuits operable to process signals and data, and to perform one or more applications or functions relating to operations of the wayside detection unit;
[27H1] wherein the wayside detection unit is operable to: determine, based on sensory data obtained from the one or more sensors, when the vehicle is approaching the wayside detection unit; and
[27H2] broadcast, to one or more companion alert devices, alert related signals, relating to the approaching of the vehicle.
Claim 28
28. The system of claim 27, wherein the wayside detection unit is operable to forward alerts and/or alert related signals communicated by one or more nearby alert devices, the one or more nearby alert devices comprises vehicle alert devices, personal alert devices and/or other wayside detection units.
Claim 29
29. The system of claim 27, wherein the wayside detection unit is operable to log data relating to alerts triggered in response to the broadcasted alert related signals.
Claim 30
30. The system of claim 27, wherein the support structure comprises a tripod or a connection element for permanent connection to wayside equipment.