

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	J. Carl Cooper	Attorney Docket No. 58936-0002IP1
U.S. Patent No.:	11,967,857	
Issue Date:	April 23, 2024	
Appl. Serial No.:	16/952,007	
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Title:	POWER SOURCE LOAD CONTROL	

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 11,967,857 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBITS

- EX1001 U.S. Patent No. 11,967,857 to Cooper (“the ’857 Patent”)
- EX1002 Excerpts from the Prosecution History of the ’857 Patent
- EX1003 Declaration and Curriculum Vitae of Dr. Steven Leeb
- EX1004 Complaint, *PSLC LLC v. Generac Power Systems, Inc.*, 2:24-cv-01270-SCD filed October 7, 2024
- EX1005 U.S. Patent Appl. No. 2006/0208574 (“Lasseter”)
- EX1006 Rashad M. Kamel & B. Kermanshahi, *Enhancement of Micro-Grid Dynamic Performance Subsequent to Islanding Process Using Storage Batteries*, 34 IRAN. J. SCI. TECH. 605 (Dec. 2010)
- EX1007 Alexander Kusko & Marc T. Thompson, POWER QUALITY IN ELECTRICAL SYSTEMS (2007)
- EX1008 U.S. Patent No. 8,410,633 (“Batzler”)
- EX1009 U.S. Patent No. 7,149,605 (“Chassin”)
- EX1010 Declaration and Curriculum Vitae of June Ann Munford
- EX1011 J.A. Peças Lopes et al., *Defining Control Strategies for MicroGrids Islanded Operation*, 21 IEEE TRANSACTIONS POWER SYSTEMS 916 (May 2006)
- EX1012 A.G. Madureira & J.A. Peças Lopes, *Coordinated Voltage Support in Distribution Networks with Distributed Generation and Microgrids*, 3 IET RENEWABLE POWER GENERATION 439 (2009)
- EX1013 Netra Gyawali & Yasuharu Ohsawa, *Improved Power Sharing Scheme for a Microgrid with Multiple Distributed Generators*, 128 IEEJ TRANSACTIONS ON ELECS., INFO. & SYSTEMS 1635 (2008)
- EX1014 Rashad M. Kamel, Aymen Chaouachi & Ken Nagasaka, *Effect*

of Wind Generation System Rating on Transient Dynamic Performance of the Micro-Grid During Islanding Mode, 1 LOW CARBON ECON. 29 (2010)

- EX1015 Robert Lasseter, *Providing Premium Power Through Distributed Resources*, PROCS. 33RD HAWAII INT’L CONF. SYS. SCIS. (2000)
- EX1016 R. H. Lasseter, *Smart Distribution: Coupled Microgrids*, 99 PROCS. IEEE 1074 (June 2011)
- EX1017 Nosh K. Medora et al., *Impact of Line Voltage Sag on Switch Mode Power Supply Operation*, 2008 3RD IEEE CONFERENCE ON INDUSTRIAL ELECTRONICS AND APPLICATIONS (July 2008)
- EX1018 Reserved
- EX1019 R.P. Rodrigues & P.M. Silveira, *A Survey of Techniques Applied to Non-stationary Waveforms in Electrical Power Systems*, IEEE PROCEEDINGS OF THE 14TH INTERNATIONAL CONFERENCE ON HARMONICS AND QUALITY OF POWER (Jan. 2010)
- EX1020 U.S. Patent Appl. No. 2004/0051387
- EX1021 U.S. Patent Publ. No. 2010/0019574 (“Baldassarre”)
- EX1022 Paul Sherz, PRACTICAL ELECTRONICS FOR INVENTORS (2000)
- EX1023 U.S. Patent Publ. No. 2007/0222294 (“Tsukida”)
- EX1024 U.S. Patent No. 8,204,632
- EX1025 U.S. Patent No. 7,356,422
- EX1026 U.S. Patent No. 7,274,975 (“Miller”)
- EX1027 U.S. Patent No. 6,314,378
- EX1028 Robert Lasseter et al., *White Paper on Integration of Distributed Energy Resources*, CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS (Apr. 2002)

- EX1029 Robert Lasseter & Pablo Piagi, *Microgrid: A Conceptual Solution*, PESCE AACHEN, GERMANY (June 25, 2004)
- EX1030 STANDARD FOR EMERGENCY AND STANDBY POWER SYSTEMS, NFPA® 110 (2010 ed.)

CONVENTIONS OF THE PETITION

- All emphases are added unless noted otherwise;
- Bold-italic emphases correlate to claim language;
- Quotations are generally from exhibits, not claim language; and
- The phrase “*supra*” and equivalent phrases incorporate fully the analysis of the cross-cited portion of the Petition.

Generac Power Systems, Inc. petitions for IPR of the below listed claims (“the Challenged Claims”) of the ’857 patent based on the grounds in this Petition.

I. REQUIREMENTS FOR IPR

A. Standing

Petitioner certifies that the ’857 patent is available for IPR, and that Petitioner is not barred or estopped from requesting IPR.

B. Challenge and Relief Requested

Generac requests IPR of the Challenged Claims on the below grounds. Dr. Steven Leeb provides supporting testimony in his Declaration. EX1003, ¶¶1-378.

Ground	Claim(s)	§103 Basis
1A	1–6, 8, 13–15, 39–43, 61–62, and 65	Lasseter-Lopes
1B	5-12, 16	Lasseter-Lopes-Miller
1C	13, 44, 63-64	Lasseter-Lopes-Baldassarre
1D	16	Lasseter-Lopes-Baldassarre-Miller

The references predate May 26, 2011, qualifying as prior art. Petitioner reserves the right to challenge the patent’s priority.

Reference	Date	Pre-AIA Section
Lasseter (EX1005)	9/21/2006 (published)	102(a)/(b)/(e)(1)
Lopes	5/31/2006	102(a)/(b)

Reference	Date	Pre-AIA Section
(EX1011)	(published)	
Miller (EX1026)	9/25/2007 (published)	102(a)/(b)/(e)(2)
Baldassarre (EX1021)	1/28/2010 (published)	102(a)/(b)/(e)(1)

The Lopes article published May 2006, being cataloged in Penn State University Library's subject-matter searchable public catalog such that an interested POSITA could have found Lopes as of 5/31/2006. EX1011, 1; EX1010, ¶¶19-22. POSITA contemporaneously found Lopes. *See* EX1012, 2, 4 ("©...2009") (citing EX1011); EX1013, 1-2 ("© 2008") (citing EX1011); EX1014, 1-2 ("© 2010") (citing EX1011).

C. Claim Construction

Unless stated otherwise or expressly defined, plain meaning is applied. However, the Challenged Claims are obvious under any reasonable *Phillips* interpretation. Petitioner reserves the right to address any subsequent issues of claim interpretation that arise in any proceeding.

"Overload" is expressly defined as "a load that if not disconnected or otherwise prevented will either cause a departure from specifications for the power output from the power source, for example such as a deviation of AC power voltage or frequency for longer than a specified time period, a loss of power such as from a

tripped circuit breaker, or damage such as overheating or exceeding mechanical stress limits.” EX1001, 7:55-62.

“Parameter” is expressly defined as “a quantity of one or more property or attribute (e.g. of a device, physical property, substance or environment) which is treated as a constant.” EX1001, 10:11-20. “A parameter may at times change or be adjusted.” *Id.* “Examples of parameters of interest herein include various horsepower, mechanical load, temperature, pressure (including altitude), humidity, power, wattage, voltage, current, including maximums, minimums, safe, starting, limited, instant, real time, near real time and timely.” *Id.*

“Timely” is expressly defined as “instant, real time, close to real time or a suitable time.” EX1001, 25:60-66.

“Know” and “known” are expressly defined as “to have been previously stored in a memory and available e.g. having been previously manufactured with, programmed with or measured.” EX1001, 26:18-21.

D. Level of Ordinary Skill in the Art

POSITA of the '857 Patent's subject matter as of May 26, 2011, would have had at least a Bachelor's degree in Electrical or Mechanical Engineering, or equivalent, and at least two-years' experience in power electronics, power generation, or backup power generation engineering. Additional graduate education could substitute for work experience. EX1003, ¶¶24-28.

II. THE '857 PATENT

A. Brief Description

The '857 Patent discloses methods of controlling backup power sources. EX1001, Abstract. Specifically, it concerns controlling a backup power source's AC-power frequency "in response to the loading on the power source." *Id.*

Given a power source's loading, the system "can determine the amount of remaining power available from the power source," if any. *Id.* If inadequate power remains—*i.e.*, if the power source is (or is about to be) overloaded—the claimed system can alter its frequency. *Id.*

B. Prosecution History

The Examiner allowed the '857 Patent because he believed the prior art did not teach:

the power source operating in such a manner so as to control the frequency of the output AC power to have a first frequency when the power source is not overloaded and a second frequency when the power source is overloaded or near to being overloaded *in addition to a processor circuit operating in response to the occurrence of the second frequency to control the amount of AC output power consumed by at least one load.*

EX1002, 40-41. But this Petition shows such processor circuits were part of the prior art. The Challenged Claims are obvious—this would have been apparent if the Examiner had the prior art presented below. EX1003, ¶¶40-49.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1A] – Claims 1–6, 8, 13–15, 39–43, 61–62, And 65 Are Obvious Over Lasseter-Lopes

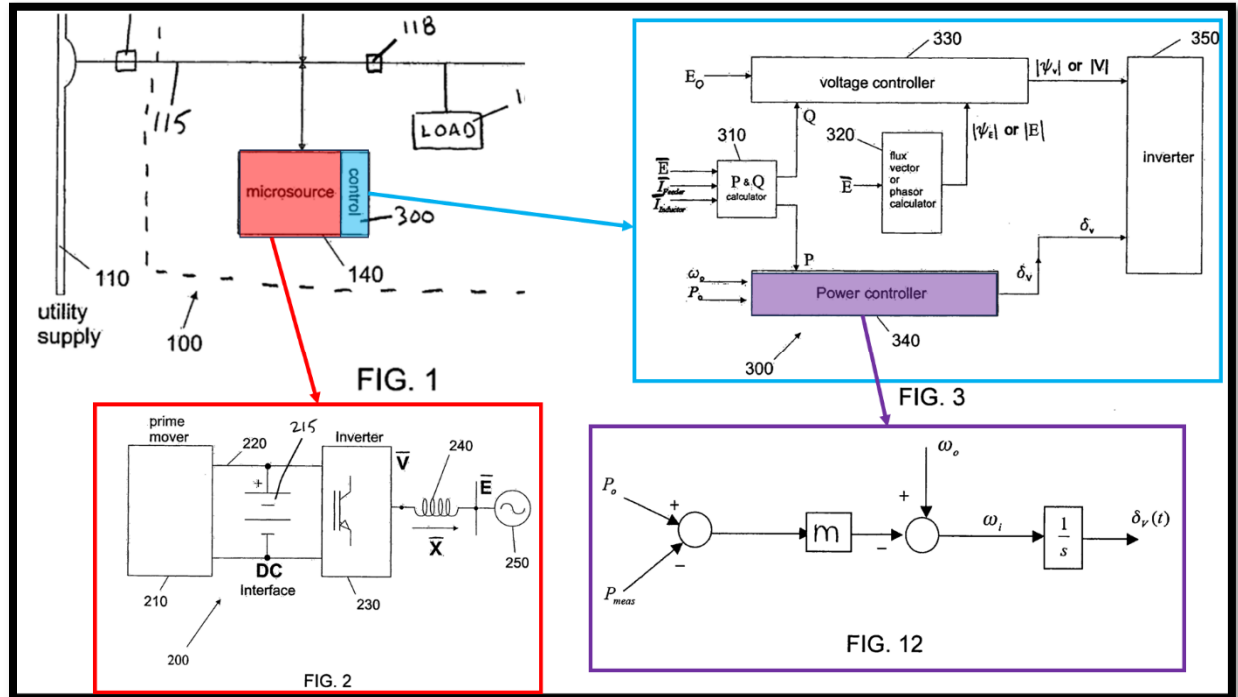
1. Lasseter (EX1005)

Lasseter concerns “distributed energy resource system[s].” EX1005, Abstract. “[D]istributed energy resources (DER)” are “independent power generation and storage systems which may be owned by, and located near, consumers of electrical power.” *Id.*, ¶[0006]. DERs “provide more reliable power...as a backup to the primary electrical supply.” *Id.*, ¶[0007]. DER power sources are called “microsources.” *Id.*, ¶[0009].

Lasseter discloses “controlling the instantaneous frequency and power from one or more microsources in ways that tend to ensure that the microsources stay within their normal operating ranges and otherwise operate effectively.” *Id.*, ¶¶[0058], [0106]-[0142], [0158]-[0171]; FIGS. 14-18, 25-29. These frequency-changing control schemes focus on “respon[ding] to events such as islanding or new loads.” *Id.* When loads demand additional power, microsource have “controllers that reduce the operating frequency of” microsources “to increase...unit output power.” *Id.*, Abstract, ¶[0110].

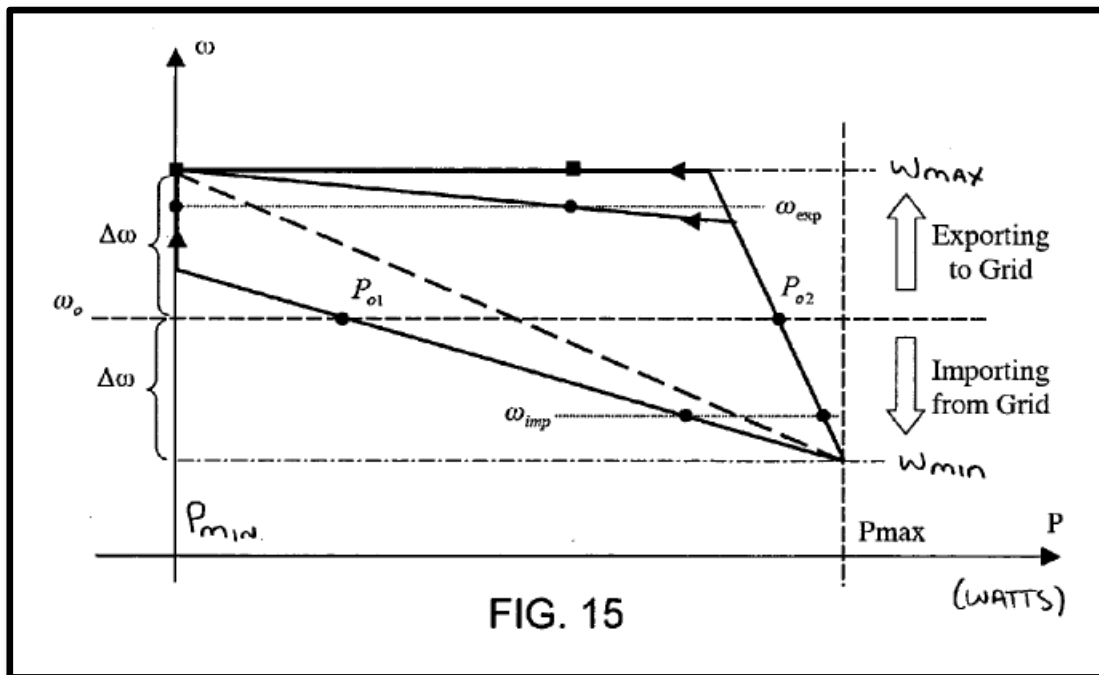
Lasseter’s “feeder lines **115**...interconnect microsource systems...and one or more loads.” *Id.*, ¶[0063], FIG. 1. “[F]eeder line 115, the interconnected microsource systems...and the one or more loads **160** can form a microgrid **117**.” *Id.* “FIG. 2 is

a diagram of an exemplary microsource **200** that can be used in a [DER] such as that of FIG. 1.” *Id.*, ¶[0070]. “FIG. 3 is a diagram of a controller **300** that can be used with a microsource such as that of FIG. 2...to control an inverter that regulates power flow from the microsource in a distributed energy resource system such as that of FIG. 1.” *Id.*, ¶[0074]. Controller **300** includes voltage controller **330** and power controller **340**. Voltage controller **330** controls “the magnitude of the inverter output voltage $|V|$,” as discussed for FIG. 5. *Id.*, ¶¶[0074]-[0076], [0086]-[0090]. Power controller **340** “control[s] the instantaneous operating frequency ω_i of the inverter [350] by changing the operating phase angle of the inverter $\delta_v(t)$.” *Id.*, ¶¶[0074]-[0076], [0107]. FIG. 12 depicts power controller **340**. *Id.*, ¶¶[0105]-[0107].



FIGS. 14-17 depict varying “unit power control” schemes power controllers

can implement to control microsources' frequency-power output. *Id.*, ¶[0105], ¶[0110]-[0141]. FIG. 15 depicts an example “relationship between steady state unit power vs. frequency (P- ω)...for two exemplary microsources.” *Id.*, ¶[0122]. They have different power-frequency slopes that depend on “power set point, P_0 and the maximum power output, $P_{\max}$, of that microsource.” *Id.*, ¶[0122]-[0132].



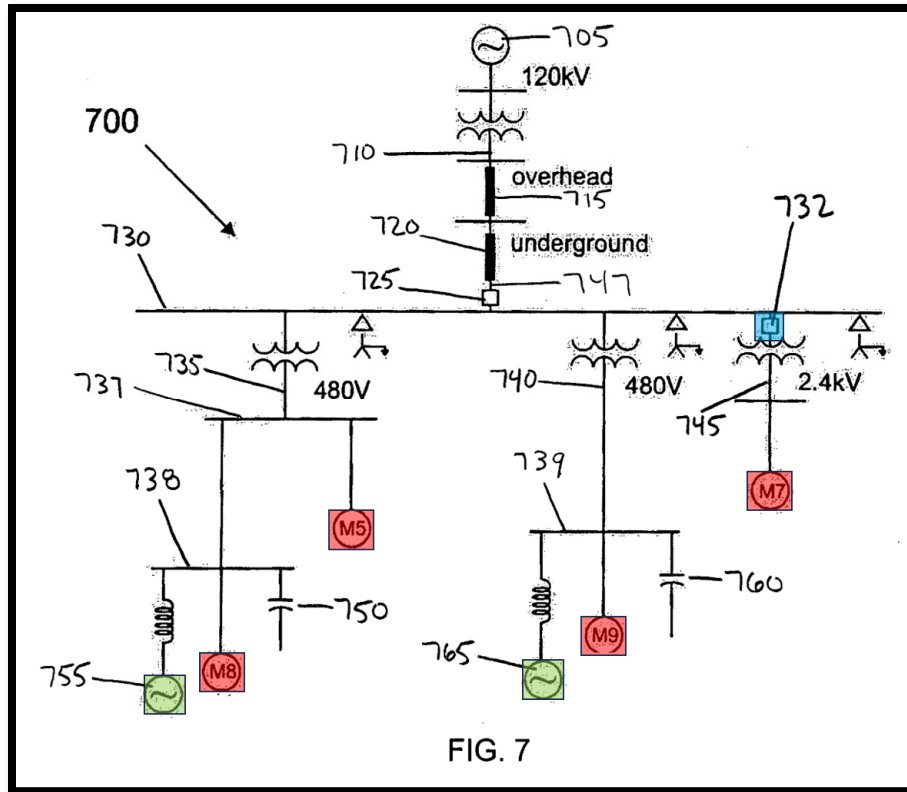
Power controller operates so that “operating characteristics for all the units converge at the point of maximum power and minimum frequency,” allowing “the power to increase more in the units that are less loaded (unit1) and increase less in the units that are more loaded (unit2).” EX1005, ¶[0117]-[0118]. Unlike natural frequency droop (e.g., EX1001, 6:28-43), Lasseter expressly controls frequency. EX1005, ¶[0012]; ¶[0015]-[0018], ¶[0057]-[0058].

Lasseter's disclosure focuses on situations where microsources can supply the connected loads in steady state, "assuming enough generation" to supply the loads or that total load is "smaller than sum of all generation." *Id.*, ¶¶[0137], ¶¶[0141]. The lines in FIGS. 14-17 representing the power-frequency relationship end at the minimum power, $P_{\min}$, and maximum power, $P_{\max}$. EX1003, ¶58. But "the minimum limit on frequency can be exceeded...if the limit on maximum power is also exceeded, *i.e.* there are more loads than generation." EX1005, ¶¶[0130]. This remains true for all unit-power schemes of FIGS. 14 and 17. *Id.*, ¶¶[0119], ¶¶[0141]. Lasseter's FIGS. 25(a)-25(b), implementing the power-frequency relationship of FIG. 17, also show power exceeding $P_{\max}$. *Id.*, FIGS. 25(a)-25(b) (power and frequency spike from D-E); EX1003, ¶58. $P_{\max}$ is a maximum rated power of the microsource, or at least it would have been obvious to set $P_{\max}$ as such—Lasseter teaches controlling power output between $P_{\min}$ and $P_{\max}$. EX1003, ¶58. Lasseter's reference confirms, calling $P_{\max}$ "the maximum rated power of the machine." EX1020, ¶¶[0112] (incorporated by reference into EX1005). Exceeding $P_{\max}$ is an "overload," per the '857 patent, because a load greater than $P_{\max}$ represents "a load" on the microsource that will "cause a departure from specifications for the power output from the source" in both a departure from the microsource's rated power specification ($P_{\min}$ - $P_{\max}$) and a departure below Lasseter's minimum-frequency specification. EX1003, ¶58. POSITA would have understood that operating a microsource beyond its maximum

rated power for long enough, if not stopped by a tripping a circuit breaker, causes damage to the microsource. EX1003, ¶58. Power is a function of voltage, current, and frequency. *Id.* (citing EX1022, 64).

$$P_{\text{ave}} = \text{Re}(VI^*) = |VI^*| \cos \phi$$

Lasseter, in certain embodiments, preemptively “disconnects” loads when it expects that “the combined power capacity of the microsources...is not adequate to supply the total load from loads.” EX1005, ¶[0099]. In one such embodiment, “the combined power capacity of the **microsources 755** and **765** is adequate to supply the combined load from **loads M5, M8, and M9**” but not **M7**. *Id.* “For this reason, when” the power system disconnects from the grid (during islanding), “**switch 732** can...open[] to disconnect...**load M7**.” *Id.*, FIG. 7.

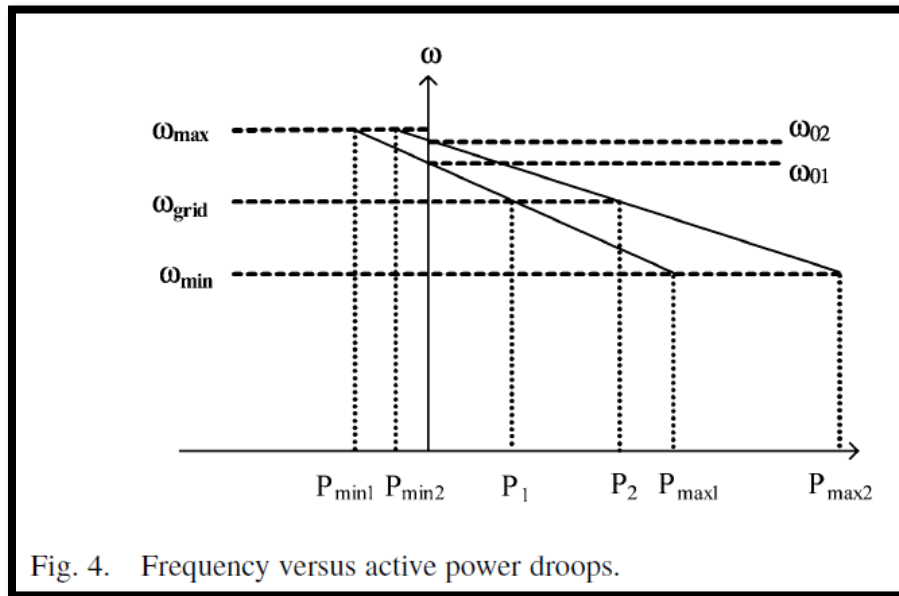


Thus, Lasseter acknowledges needing additional control strategies when load exceeds supply.

2. Lopes (EX1011)

Lopes concerns control strategies for islanded-DER operation with microsources like Lasseter's. EX1011, 1. Lopes "further developed" a "control scheme based on droop concepts to operate in terms of feeding a standalone ac system," a controlled-droop system similar to Lasseter. *Id.*, 8 (citing EX1015, an earlier Lasseter paper); EX1015 at 3, FIG. 1, 6-7, FIGS. 8, 11-14. Like Lasseter, Lopes' inverters actively "control[] voltage and frequency on the ac system...through droops." EX1011, 3-4.

According to Lopes, DERs disconnecting from the grid “must have the ability to operate stably and autonomously.” EX1011, 1. Like Lasseter, as shown in Lopes’ Figure 4, Lopes’ microsources increase power generation by changing output frequency up to max-power outputs:



But when loads exceed generation, Lopes explains that there can be an “overload.” *Id.*, 4. “[H]igh imbalance between local load and generation may lead to large frequency deviations and transient overload of” inverters. *Id.*, 4. To address overloads, Lopes uses “load shedding strategies...to avoid large frequency and voltage excursions.” *Id.*, 2. “The amount of load to be shed is defined based on the amplitude of frequency deviation.” *Id.*, 5. Thus, Lopes advocates allowing “a temporary disconnection of less important loads...activated by under-frequency relays.” *Id.*, 6.

3. The Combination, Reasons to Combine, & Expectation of Success

Because POSITA would have recognized the benefit of combining Lasseter and Lopes—doing so would have been obvious. EX1003, ¶¶69-83, ¶211, ¶288. Indeed, according to the inventor (who prosecuted the '857 Patent), “such combinations of” power sources controlling AC frequency with load shedding systems “are readily apparent to the person of ordinary skill.” EX1002, 3; EX1016, 3, 5. Moreover, Lopes cites several microgrid-related-Lasseter papers. EX1015, EX1028, EX1029. As discussed, *supra* §III.A.1, Lasseter discloses methods of controlling power source frequency to alter output power in response to changing loads. While Lasseter addresses instances where microsources can fully supply steady-state power demanded by the connected loads, Lasseter acknowledges that “the combined power capacity of the microsources...is not” always “adequate to supply the total load.” *Id.*, ¶[0099]. Thus, Lasseter discloses a situation it does not explain how to address—where the combined generation capacity is insufficient to supply the potential total load. For the below reasons, it would have been obvious to supply generation capacity needed for expected steady-state operation of the connected loads and employ a responsive (rather than preemptive) load-shedding strategy, such as Lopes’, in Lasseter’s system to temporarily disconnect less important (e.g., non-critical) loads when necessary. EX1003, ¶¶71-72. Load shedding in response to frequency deviation was a well-known technique at the time.

Id. (citing EX1006, 7; EX1023, ¶¶[0002]-[0004]); EX1009, 8:63-9:41; EX1023, Abstract. POSITA would have further found it obvious to set the load-shedding threshold at or below Lasseter's minimum frequency, potentially allowing frequency deviation to the lower specified threshold as loading demands. EX1003, ¶¶71-72 (discussing how thresholds below minimum frequency/maximum power were common, citing EX1006, 7 and EX1005, FIG. 25(a); EX1023, ¶[0004]). POSITA would have been motivated to combine Lasseter with Lopes' frequency-deviation-load-shedding strategy for multiple reasons.

First, because Lasseter does not detail what to do when its microsources' generation capacity is inadequate to supply the total potential load, POSITA would have looked to Lopes and its responsive frequency-based load-shedding scheme for solutions. EX1003, ¶73. POSITA would have been motivated to apply responsive load shedding, as in Lopes, instead of providing excess generation capacity, which, as explained below, has drawbacks. Lopes explains, "[t]he key issue for successful MG islanded operation is the management of load shedding." EX1011, 7-8. POSITA would have further set the load-shedding threshold at or below Lasseter's minimum frequency to prevent overload or significant overload—including excursions beyond Lasseter's specified $P_{\max}$ —when the total load exceeds the available generation capacity. *Id.*; EX1003, ¶54-73. POSITA would have understood that thresholds below Lasseter's minimum frequency would beneficially

allow the system to operate through less significant excursions beyond $P_{\max}$, ensuring loads are not unnecessarily shed for manageable excursions (e.g., where the overload condition is not sustained). EX1003, ¶74 (discussing a less significant excursion in EX1005, FIG. 25(a) and collecting cites). Applying load shedding to Lasseter based on (or below) its minimum frequency would simply combine “familiar elements according to known methods,” *i.e.*, applying load shedding for its intended purpose of responsively eliminating loads to ensure sufficient generation capacity, to “yield predictable results,” *i.e.*, a variable total load appropriate for the available generation capacity. *KSR Intern. Co. v. Teleflex Inc.*, 550 U.S. 398, 401 (2007); EX1003, ¶75.

Second, employing responsive load-shedding activated at or below Lasseter’s minimum frequency could avoid inefficiencies from excess generation capacities. Without responsive load shedding, systems must maintain more generative capacity than max-potential load. EX1003, ¶76. This is inefficient—typical loads do not constantly demand maximum power, resulting in unnecessary cost from unused generative capacity. EX1003, ¶76. Indeed, there are cost, size, fuel consumption, and system complexity implications to having excess generative capacity in backup power sources. EX1003, ¶76. In view of Lopes’ express example of power-management load shedding, POSITA would have found it obvious to ensure generative capacity was sufficient for typical operation, deploying Lopes’ load-shedding strategies when Lasseter reached or exceeded its minimum frequency and

maximum-power output. EX1003, ¶76. Doing so would avoid excess-generative-capacity inefficiencies while always providing adequate power to the connected loads during typical operation. EX1003, ¶76.

Third, Lasseter teaches that one could alternatively impose an express power-output limit, but this could result in providing less power than the loads demanded. EX1003, ¶77. While certain Lasseter embodiments “actively enforce[]” limits on power output, Lasseter describes this as a “disadvantage” compared to situations with “enough generation” to power the loads. EX1005, ¶[0137]. Supplying less than demanded power is undesirable, especially for critical loads (*e.g.*, life support). EX1003, ¶77. In contrast, shedding and reconnecting “less important” loads—only as needed—ensures critical loads can continue to receive power. EX1003, ¶77; EX1011, 4.

Fourth, POSITA would have been especially motivated to employ load shedding in systems where only some loads are truly critical. EX1003, ¶78. Hospitals provide a paradigmatic example: “interruption of power...can have life-threatening consequences.” EX1005, ¶[0007]. Under normal operation, DERs supply both critical loads (*e.g.*, life-support machines) and non-critical loads (*e.g.*, air conditioning). *Id.*, ¶[0099]; EX1003, ¶78. Lasseter discloses systems that preemptively disconnects non-critical loads (M7) (like air conditioning) in favor of critical loads (M5, M8, M9), EX1005, ¶[0099], such as life support. But because

loads vary over time, there may be periods when both critical and non-critical loads can be adequately powered. *Id.*, ¶[0104]; EX1003, ¶78. In such circumstances—where non-critical loads can sometimes remain online without jeopardizing critical ones—POSITA would have been motivated to delay Lasseter’s shedding of “less important loads” until necessary (and only do so “temporar[ily]”) to preserve adequate power for critical applications, as Lopes teaches. EX1011, 4; EX1003, ¶78.

Fifth, POSITA would have been motivated to combine Lasseter and Lopes to avoid drawbacks associated with Lasseter’s preemptive load disconnection. EX1003, ¶79; EX1005, ¶[0099]. Though this prevents loads from exceeding generation at times of high-power demand, it prevents power sources from powering said loads at times of low-power demand. EX1003, ¶79. Even if a power source cannot supply the maximum-possible load, it may be able to power all loads at times of low-power demand. EX1003, ¶79; EX1001, 7:5-22. Doing so could avoid costs associated with disconnecting lower-priority loads, like sensitive electronics that have restart times or manufacturing processes where interruption results in “wasted material in process that must be scrapped.” EX1005, ¶[0099]. Disconnecting low-priority loads can have drawbacks which need not be borne in all instances when systems employ Lopes’ load-shedding strategy rather than always preemptively disconnecting loads as Lasseter discloses. EX1003, ¶79.

Sixth, shedding loads only when necessary (as in Lopes) helps power sources

operate near maximum-output (and most efficient), motivating POSITA. EX1003, ¶80. “Microsources are expected to operate most of their time with power outputs near maximum because of the better efficiencies enjoyed at this higher operating points.” EX1005, ¶[0132]; EX1001, 3:21-36, 4:7-53. Preemptive load-shedding may result in shedding loads the microsource could have otherwise powered and have operated nearer to its maximum (more efficient) power output. EX1003, ¶80. Employing Lopes’ load shedding based on the frequency droop indicative of loading would result in a more efficient use of power resources. EX1003, ¶80.

POSITA would have reasonably expected success in the combination. EX1003, ¶81. It implements “well-known” benefits of load-shedding in response to decreased frequency for Lasseter’s microsource systems, which already decrease frequency as a function of increased loading. EX1005, Abstract; EX1003, ¶81 (quoting EX1006, 611). This implementation achieves predictable improvements (i.e., ensuring only loads that can be adequately powered are connected to Lasseter’s microsources) without impacting the operating principle of Lasseter’s microsource power-control systems. EX1003, ¶81.

Rather than impact it, this combination is a commonsense improvement to the operating principle of Lasseter’s microsources once outputting max-power. Further loading will not receive the demanded power. EX1003, ¶82. Lasseter already prescribes a minimum frequency for the max-power; Lopes supplies the obvious

next step—shed loads at or below that frequency rather than persist with inadequate power delivery. EX1003, ¶82.

Combining Lasseter with Lopes would have been nothing more than integrating Lasseter’s teachings with Lopes’ “well-known” load-shedding techniques, both relating to DERs. EX1003, ¶¶82-83 (quoting EX1006, 611). The fundamental aspects of Lasseter’s frequency manipulating power sources, bolstered by the beneficial aspects of Lopes’ load-shedding scheme, result in a reasonable expectation of success. *Id.*

4. Claim Element Analysis

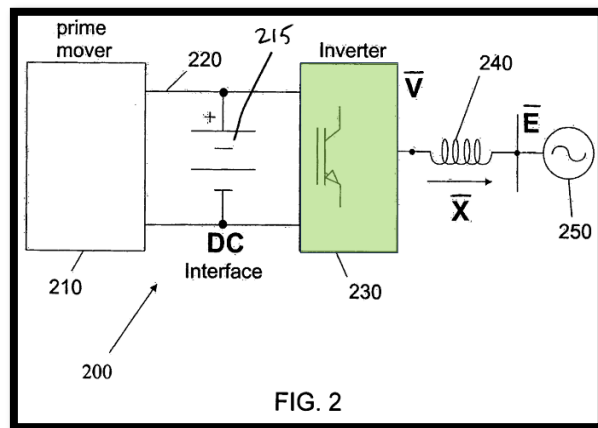
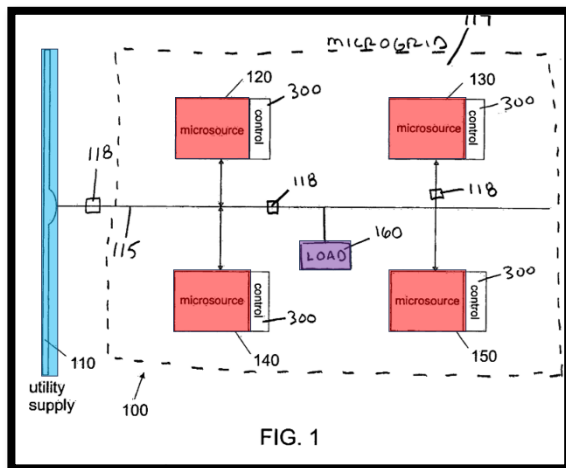
[1.pre] A power system which provides A.C. power with a controlled A.C. frequency to assist in managing the loading thereof, the power system comprising:

If limiting, Lasseter’s “distributed energy resource system” (DER) the claimed ***power system***. EX1005, Abstract, ¶¶[0063]-[0069], FIG. 1 (equating DERs and microgrids); EX1011, 1 (noting “MG” stands for microgrid); EX1003, ¶84. DERs comprise “microsource[(s)]” that output “AC voltage or current at the required frequency.” EX1005, ¶[0010], ¶¶[0015]-[0018], ¶¶[0071]-[0088], FIG. 1. Frequency is ***controlled***—Lasseter discloses “control schemes for controlling the instantaneous frequency...from one or more microsources.” *Id.*, ¶[0058], ¶¶[0014]-[0018], ¶[0142]. This control ***assists in managing the*** DER’s ***loading***—frequency is controlled “in response to events such as islanding or new loads.” *Id.*; EX1003,

¶¶85-105.

[1.a] a non-utility type power source comprising an inverter which provides single or multiple phase output A.C. power to one or more of a plurality of loads, the power source having at least one maximum output power parameter which if exceeded causes an overload of the power source, the output A.C. power having an A.C. frequency, which frequency is controlled in response to the timely amount of the output A.C. power;

Lasseter's microsources are *non-utility type power sources comprising an inverter*—FIG. 1 distinguishes “microsources” 120-50 from “utility supply” 110. *Id.*, FIG. 7, ¶¶[0150]-[0151], ¶[0172]. “[M]icrosource 200...can be used in a [DER]...of FIG. 1,” which “may include” a “inverter 230”/“inverter 350” *Id.*, ¶¶[0015]-[0018], ¶¶[0069]-[0070], ¶[0074], FIGS. 1-3. EX1003, ¶¶86-92



Further, *inverter 230/350 provides single or multiple phase output A.C. power* to “one or more loads 160.” *Id.*, ¶¶[0015]-[0018], ¶[0063], ¶[0072]. “[I]nverter 230 controls [the] phase of its output voltage,” meaning *inverter 230/350* inverts interface 220’s DC power to AC power in at least single or multiple phases. *Id.*, ¶¶[0073]-[0074], FIGS. 1-3, EX1003, ¶¶86-87.

Lasseter's microsources necessarily have a *maximum-output power parameter* where, if exceeded, an overload occurs, per the '857 patent. *Supra* Part III.A.1; EX1003, ¶88. A maximum-output power parameter is inherent of all microsources. *Id.*

Nonetheless, Lasseter's microsources have a "maximum output power," $P_{\max}$, which they reach "at the same time" as their "minimum operating frequency." EX1005, ¶¶[0015], [0117]-[0118], [0130]. $P_{\max}$ is the maximum rated power of the microsource, EX1020, ¶[0112], so it is a *maximum-output power parameter*. EX1003, ¶89.

$P_{\max}$ is a parameter per the '857 patent—it is "a quantity of...[an] attribute" of the microsources, *i.e.*, the maximum rated power, "treated as constant" throughout Lasseter (although it "may at times change"). EX1003, ¶90; EX1020, ¶[0112] (" $P_{\max}$ is the maximum rated power of the machine."). The '857 patent teaches $P_{\max}$: "power...including maximums...instant, real time, near real time and timely." EX1001, 10:11-20.

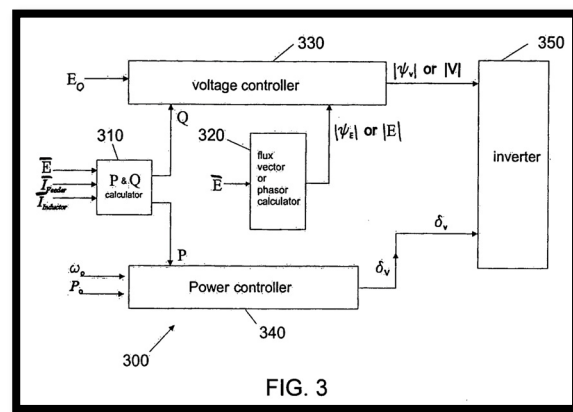
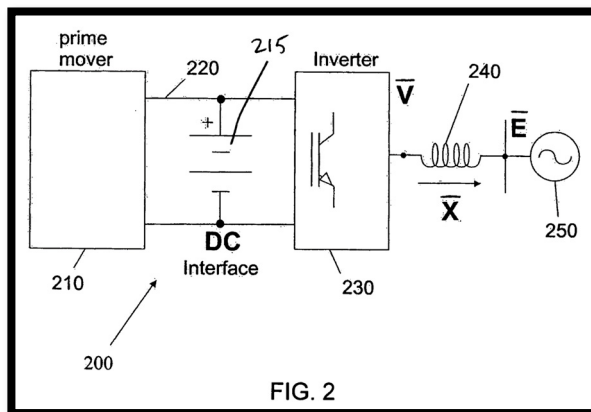
Exceeding microsources' $P_{\max}$ causes an *overload*, per the '857 patent, because power beyond $P_{\max}$ (the rated maximum power) "depart[s] from specifications for the power output from the power source" both in power and frequency. *Supra*, §III.A.1; EX1003, ¶91.

Finally, Lasseter discloses "control schemes for controlling the instantaneous

frequency...from one or more microsources.” EX1005, ¶¶[0057]-[0058], ¶[0107], ¶¶[0114]-[0115]. Frequency is controlled “in response to events such as islanding or new loads.” *Id.* Because loading determines the inverters’ necessary output power, EX1003, ¶92 Lasseter’s inverters’ *frequency is controlled in response to the timely amount of the output A.C. power. Infra*, [1.b].

[1.b] a power sensing circuit which may be part of the power source or otherwise and is responsive to the timely amount of the output A.C. power, the power source operating in response to the power sensing circuit to control the frequency of the output A.C. power to have a first frequency when the power source is not overloaded and a second frequency when the power source is overloaded or is near to being overloaded;

Lasseter’s microsources have *power-sensing circuits*—controller **300**—“that can be used with [the] microsource...of FIG. 2.” EX1005, ¶¶[0074]-[0076], [0063], FIG. 3. Controller **300** is *part of the power source*. EX1003, ¶93, ¶¶93-102.



Controller **300** is *responsive to the timely amount of the output A.C. power*—

its P&Q calculator **310** calculates *output A.C. power*, “real power [P_{meas}]¹ being injected by the microsource,” based on “instantaneous current and voltage measurements” at inverter **230**’s/**350**’s output. *Id.*, ¶¶[0074]-[0077], FIGS. 3, 5, 12; EX1003, ¶93-102 (citing EX1022, 64).

$$P_{\text{ave}} = \text{Re}(VI^*) = |VI^*| \cos \phi$$

“Exemplary inputs to the controller **300** can include...three measured states.” *Id.*, ¶¶[0075], [0077], [0086]. “[M]easured state variables can be obtained from instantaneous voltage or current measurements that can be made locally,” including “ I_{inductor} , the time varying current injected by the microsource” and “E: the system voltage at the connection point.” *Id.*, ¶[0014], ¶[0075]. P_{meas} is *timely*, per the ’857 patent, because it comes from “instantaneous current and voltage measurements”

¹ Real Power P is P_{meas} . EX1003, ¶98. P_o is the same in FIGS. 3 and 12; P and P_{meas} are the same, too. FIG. 3 depicts power controller **340** receiving inputs: ω_0 , P_o , and Real Power P to control ω_i . FIG. 12’s power controller also receives ω_0 and P_o as inputs to control ω_i but labels its power input P_{meas} . Though FIG. 12 adds the “measured” subscript, Lasseter explains that Real Power P is calculated by P&Q calculator **310** based on measurements. EX1005 ¶[0073], ¶[0077]; EX1003, ¶98.

and is used to control “the instantaneous operating frequency ω_i of the inverter” and is thus “instant, real time, close to real time or a suitable time.” EX1003, ¶95; EX1005, ¶[0075].

Moreover, microsources (*power sources*) *operate in response to* controller **300** when “reducing the operating frequency of the inverter to increase [their] unit output power.” EX1005, Abstract, ¶¶[0015]-[0018], [0075], [0107], [0111]; EX1003, ¶96. Controller **300** includes “power controller **340** in FIG. 3,” which “uses...measured power P_{meas} ,” “to control the instantaneous operating frequency ω_i of the inverter.” *Id.*, ¶[0075], ¶¶[0105]-[0107]. When P_{meas} exceeds power set point, P_0 , frequency decreases from *first frequency* ω_0 . EX1003, ¶¶96-97.

$$\omega_i = \omega_0 - m(P_0 - P_{\text{meas}})$$

[Eq. 8]

When operating at *first frequency* ω_0 , microsources are not overloaded, per the '857 patent—they operate within rated power specification, between minimum-rated power (P_{min}) and maximum-rated power (P_{max}). EX1005, FIGS. 14-17; EX1003, ¶¶99-100. POSITA would have understood, or found obvious, microsource loading between P_{min} and P_{max} would not “cause a departure from specifications for the power output from the power source.” *Id.*

Where “load exceeds the aggregate power capacity of the units,” and microsources exceed P_{max} , microsources drop below “minimum operating

frequency.” EX1005, ¶¶[0118]-[0119], ¶[0141], FIGS. 14-17; *supra* [1.a]. This constitutes *overload*, per the ’857 patent, and frequency below the minimum frequency is *a second frequency*. *Supra*, §III.A.1-2 (beyond $P_{\max}$ is an overload); EX1011, 4, 5, 8 (overload); EX1003, ¶¶101-102. Lasseter similarly teaches when the microsource reaches $P_{\max}$, *i.e.*, *near to being overloaded*, frequency drops to “minimum operating frequency,” *i.e.*, *a second frequency*. *Id.*

[1.c] a processor circuit comprising one or more processors responsive to the output A.C. power, the processor circuit operating in response to the occurrence of the second frequency to control the output A.C. power consumed by at least one load of the one or more loads thereby helping to prevent or alleviate an overload of the power source.

Lopes supplies algorithms for “shedding” “controllable loads” “based on the amplitude of frequency deviation.” EX1011, 4-5. Load shedding *controls output A.C. power consumed by the load*, because it “[a]llow[s] a temporary disconnection of less important loads.” *Id.* Shedding loads can cure “high imbalance between local load and generation,” *preventing or alleviating* “frequency deviations and transient *overload[s]*” including an overload of the power source, per the ’857 patent, *e.g.*, excursions beyond $P_{\max}$. *Id.*; EX1003, ¶¶103-105.

Lopes’ load-shedding algorithm *is responsive to* “amplitude of the frequency deviation” (reflecting changes in *output A.C. power*), specifying “a certain amount of load” to be “automatically shed through the activation of under-frequency load shedding relays” based on “frequency deviation” (*the second frequency*). EX1011,

6; EX1003, ¶104. POSITA would have been motivated to implement Lopes with specified frequency deviations at or below a microsource's minimum frequency. EX1011, 3, FIG. 4; EX1003, ¶104.

Lopes' load-shedding algorithm operates on "controllers located at loads or groups of loads [load controller (LC)]" and "under-frequency relays," which POSITA would have understood constitute *a processor circuit comprising one or more processors*. EX1011, 1-2, 4, 6, FIG.1; EX1003, ¶105. Because processor circuits were well-known with well-understood benefits, it would have been obvious to implement load-shedding algorithms on processor circuits to benefit from modern computing's and control systems' speed and convenience. EX1003, ¶105 (citing EX1021, EX1024, EX1025, and EX1027 as examples of processors in load-shedding applications).

[2.] A power system as claimed in claim 1 wherein when the one or more loads demand more power than the inverter can produce, the power source changes the A.C. power output frequency from the first frequency to the second frequency to signal the processor circuit to shed one or more of the plurality of loads to help the power source to recover from an overload.

When *loads demand more power than* microsource inverter's maximum-output power, the microsource drops to or below its minimum operating frequency—*the second frequency*. *Supra* [1.a]; EX1003, ¶106. The second frequency being at or below Lasseter's minimum frequency signals the under-frequency relays to shed loads. EX1011, 4; EX1003, ¶106. Shedding loads would "aid frequency

restoration,” *helping the power source recover from an overload*. EX1011, 6; EX1005, ¶¶[0099]; EX1003, ¶106.

[3.] A power system as claimed in claim 1 wherein the power source is used as a backup power source when utility power fails.

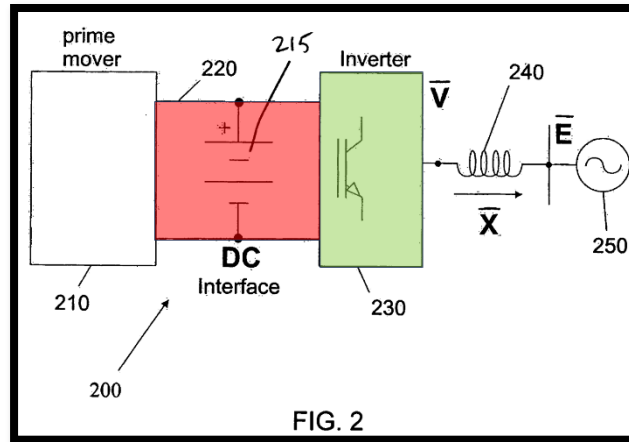
DERs “can provide more reliable power in critical applications, as a backup to the primary electrical supply.” EX1005, ¶¶[0007]-[0008]. “[P]ower sources can...provide backup to their owners when the main power grid is unavailable.” *Id.*; EX1003, ¶107. POSITA would have understood, or found obvious, the same is true of Lasseter’s DER. EX1003, ¶107.

[4.] A power system as claimed in claim 1 wherein the inverter is responsive to power provided by a generator comprising an internal combustion engine to provide the output A.C. power.

Lasseter’s “microsource control methods...can be used to control *inverter* interfaces found in...*internal combustion engines*.” EX1005, ¶¶[0064]-[0069]; EX1003, ¶108.

[5.] A power system as claimed in claim 1 wherein the inverter is responsive to at least one rechargeable battery to provide the output A.C. power.

Lasseter’s “microsource 200 may also include **power storage 215**, for example a **battery**.” EX1005, ¶¶[0070]-[0071], ¶[0010], ¶[0064]. POSITA would have understood, or found obvious (*e.g.*, at least in view of Lopes’ rechargeable storage devices, EX1011, 5), Lasseter’s battery is *rechargeable*, given its position between prime mover and inverter suggesting prime mover’s power supplies or recharges the battery. EX1005, ¶¶[0070]-[0074], FIG. 2; EX1003, ¶¶108-110.



Because **battery 215** is the “DC Interface” outputting power to the **inverter 230/350**, *the inverter is responsive to the battery* by producing AC power from the battery’s DC power. *Id.*; EX1003, ¶110.

[6.] A power system as claimed in claim 5 wherein the power system controls the charging of the at least one rechargeable battery.

POSITA would have understood controller **300** controls the power flowing out of prime mover **210** through the inverter, and thus the amount of power flowing into and out of battery **215**, affecting charging. EX1005, ¶[0074] (voltage controller **330**, power controller **340**); EX1003, ¶111. POSITA would have understood, or found obvious, power controller **300 controls charging the battery** with its control of the inverter. *Id.*

[8.] A power system as claimed in claim 6 wherein the power system controls the charging of the at least one rechargeable battery from at least one solar panel.

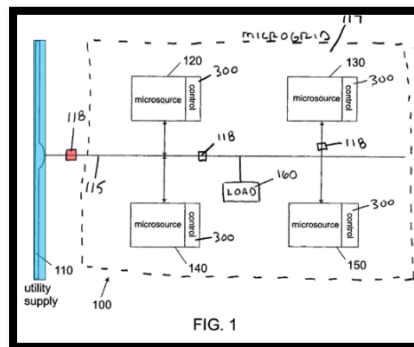
“[P]rime mover **210** can be...[a] PV.” *Id.* PV means “photovoltaic array,” which POSITA would have understood or found obvious to be **solar panels**, given

solar panels' ubiquity in photovoltaic arrays. *See id.*, ¶¶[0064]; EX1003, ¶¶112-113.

Accordingly, solar panels charge the Lasseter's battery. *Id.*

[13.] A power system as claimed in claim 1 further including a transfer switch which may select a power grid or the power source to provide power to the one or more of a plurality of loads, the transfer switch outputting power from the grid power meets acceptable parameters and to output power from the power source when the grid power does not meet acceptable standards.

Lasseter discloses “**interface switches 118,**” (*transfer switch*) which “can be positioned between the feeder line 115 and the **main utility supply 110** so that...microsource[s]” 120-50 and “loads 160, can be isolated from...**utility supply 110.**” EX1005, ¶¶[0065]-[0066].



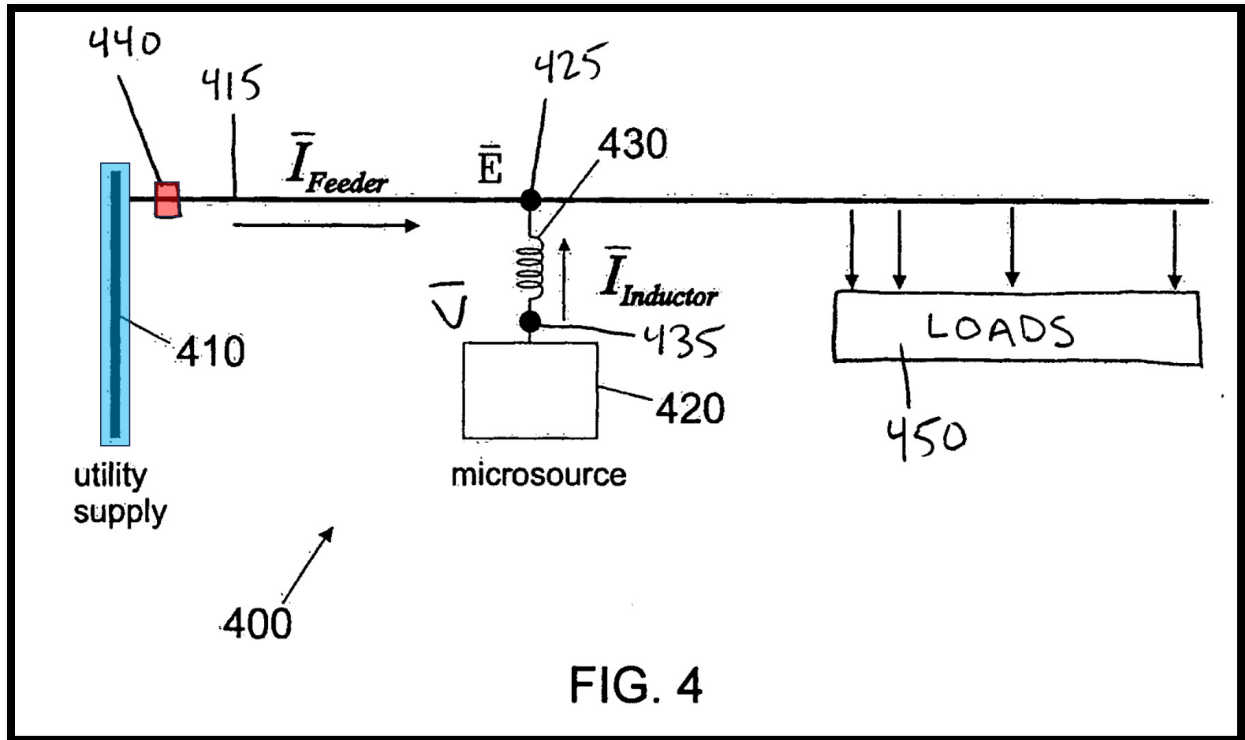


FIG. 4 shows “state variables in an exemplary [DER], such as that of FIG. 1.” EX1005, ¶[0023]. FIG. 4 depicts “switch 440 [transfer switch] that can be opened to isolate the microsource 420 and loads 450 from the utility supply 410.” EX1005, ¶[0084]; EX1003, ¶114, ¶¶114-17.

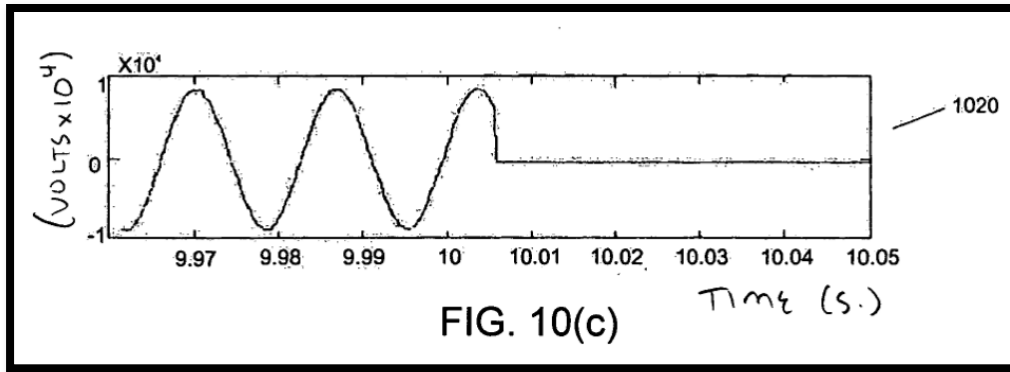
FIG. 7 “illustrate[s] the dynamics of the microsource controls described with reference to FIGS. 1-6.” EX1005, ¶¶[0091]-[0093]. FIG. 7 shows *transfer switches*—switches 725 and 732—where switch 725 can be used to disconnect the bus 730 from the utility supply 705 on feeder line 710. *Id.*

Alternatively, POSITA would have found obvious that the same functionality could have been achieved by providing transfer switch 725 at the connection between feeder line 710 and bus 730, selectively connecting feeder line 710 to one

or both halves of bus **730** or disconnecting feeder line **710**, because different switch configurations were commonplace at the relevant time (EX1011, FIG. 1 switches; EX1021, FIG. 1 switch **108**; EX1007, 36; EX1030, 36-37) and a switch's particular placement and accompanying circuit configurations were obvious matters of design choice or options POSITA would readily envisage. *In re Japikse*, 181 F.2d 1019 (CCPA 1950); *In re Kuhle*, 526 F.2d 533 (CCPA 1975); *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015). POSITA would explore these different circuit configurations (e.g., for flexibility) to allow all or part of bus **730** to be used at a given time. EX1003, ¶114-117.

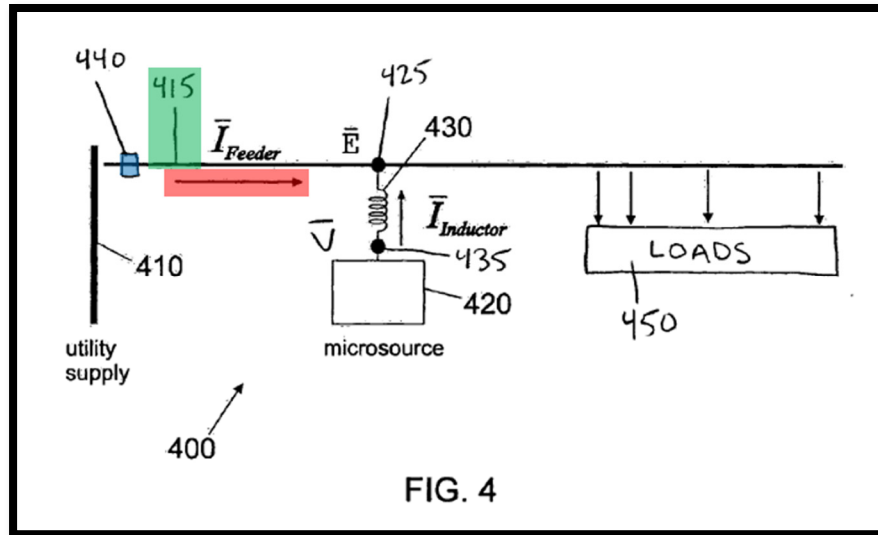
Lasseter's systems can "move[] from grid connected to island operation by opening switch **725** to disconnect the plant **700** from the feeder **710** [connecting utility supply **705** to the microgrid bus **730**] in response to the loss of power from the" utility, i.e., *when grid power* switches from *meeting acceptable parameters* (supplying power at constant voltage and frequency) to *not meeting acceptable parameters* (not doing so). EX1005, ¶[0099]-[0103], FIGS. 10(a)-10(c); EX1003, ¶116.

Voltage and frequency are parameters, per the '857 patent, because each is "a quantity of...[an] attribute" of the utility grid power—the voltage or frequency—"treated as constant" in FIG. 10(c) until "loss of power." EX1003, ¶117; EX1005, ¶[0029], [0100]-[0101], FIG. 10(c).



[14.] A power system as claimed in claim 1 further including a transfer switch which may select a power grid or the power source to provide power to the one or more of a plurality of loads, the transfer switch outputting power from the power grid when grid power meets acceptable standards and may output power from the power source when the grid power does not meet acceptable standards, the power sensing circuit of b) comprising one or more current sensors electrically located to sense current output from the transfer switch.

Supra [13]. Controller **300** (*power-sensing circuit*) includes power controller **340**. EX1005, FIG. 3. Power controller **340** is discussed above in connection with unit power control, but “power controller **340** in FIG. 3, can be classified into...a mixed system using both unit power control and zone power control” too. EX1005, ¶[0105]. Under zone power control in a mixed configuration, I_{Feeder} would be used to calculate real power. EX1005 ¶¶[0075]-[0077]. I_{Feeder} “can be obtained from instantaneous voltage or current measurements that can be made locally.” EX1005, ¶[0075]. I_{Feeder} is the “time varying current in the **feeder**” **415** output from “**switch** **440**.” EX1005, ¶[0075], ¶[0084], FIG. 4; EX1003, ¶¶118-19.

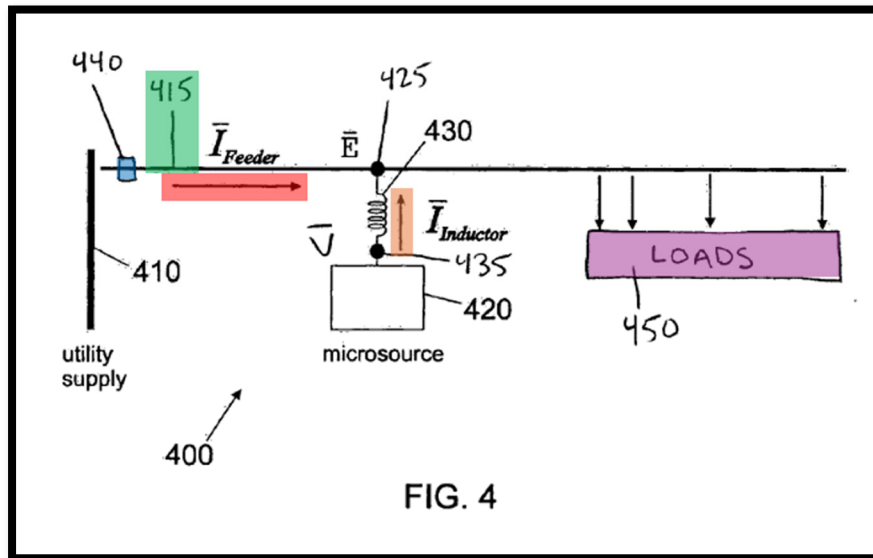


DERs can operate where they are “importing power from the grid” or “exporting power to the grid.” EX1005, ¶¶[0111]-[0116], ¶[0124], ¶¶[0134]-[0136], ¶¶[0139]-[0140], FIGS. 14-17. For DERs importing power, POSITA would have understood, or found obvious, controller 300 senses current I_{Feeder} output from switch 440 with a current sensor on the path through which current would flow into the DER. EX1003, ¶119.

[15.] A power system as claimed in claim 1 further including a transfer switch which may select a power grid or the power source to provide power to the one or more of a plurality of loads, the transfer switch operating to select the power grid when grid power meets acceptable standards and to select the power source when the grid power does not meet acceptable standards, the power sensing circuit of b) comprising one or more current sensors electrically located to sense current output from the transfer switch and thereby are responsive to the amount of current being provided to the one or more of a plurality of loads by the power grid when the transfer switch selects the power grid and to sense the amount of current being provided to the one or more of a plurality of loads by the power source when the transfer switch selects the power source.

Supra [13]-[14]. Current I_{Feeder} is provided to loads 450 from utility supply

410 (power grid) when switch 440 is closed (*when power grid is selected*). EX1005, FIG. 4; EX1003, ¶¶120-122. The current sensor located to sense current output from switch 440 is *responsive to the amount of current being provided to loads 450* because it measures I_{Feeder} passing through switch 440. EX1003, ¶120, ¶¶120-22.



When switch 440 opens (*when the transfer switch selects the power source*), controller 300 *senses the amount of current $I_{Inductor}$ being provided to loads 450* by microsource 420. POSITA would have understood, or found obvious, controller 300 *senses current $I_{Inductor}$* with a second of the *one or more current sensors* on the path current in FIG. 4 flows toward *loads 450*. EX1003, ¶¶121-122.

[39.pre] A power system which provides AC power with a controlled AC frequency to assist in managing the loading thereof, the power system comprising:

Supra [1.pre]; EX1003, ¶¶123-27.

[39.a] a non-utility type power source having one or more inverter which provides single or multiple phase output AC power to one or more of a plurality of loads, the power source having at least one power system parameter which if exceeded indicates an actual or potential overload of the power source, the output AC power having an AC frequency, which frequency is controlled in response to a timely amount of a parameter of the power source;

Supra [1.a]. $P_{\max}$ is *power-system parameter* and P_{meas} is *parameter of the power source*. EX1003, ¶¶124-125. Both are parameters, per the '857 patent, because each is “a quantity of...[an] attribute” of the microsources—the maximum-/measured-rated power, “treated as constant” throughout Lasseter ($P_{\max}$) and in each instant (P_{meas}). EX1003, ¶124; EX1020, ¶[0112] (“ $P_{\max}$ is the maximum rated power of the machine.”). Both are exemplified in the '857 Patent: “power...including maximums...instant, real time, near real time and timely.” EX1001, 10:11-20.

When exceeding $P_{\max}$, overload results. *Supra* [1.a]-[1.b]. Given this relationship, exceeding $P_{\max}$ *indicates* overload. *Supra* Part III.A.1; EX1003, ¶124.

[39.b] a sensing circuit which may be part of the power source or otherwise and is responsive to the timely amount of at least one loading parameter of the power source, the power source operating in response to the sensing circuit and the at least one power system parameter to control the frequency of the output AC power to have a first frequency when the power source is not overloaded and a second frequency when the power source is overloaded or is near to being overloaded;

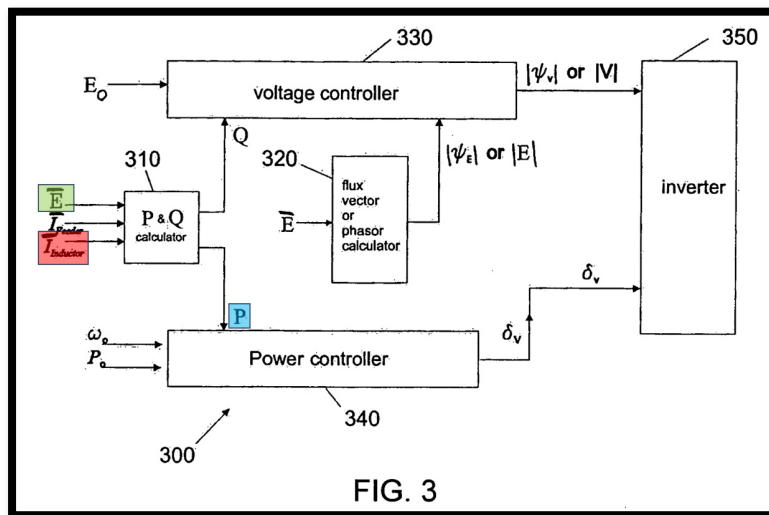
Supra [1.b], [13], [39.a].

[39.c] a processor circuit comprising one or more processors responsive to the output AC power, the processor circuit operating in response to the occurrence of the second frequency to control the output AC power consumed by at least one load of the one or more loads thereby helping to prevent or alleviate an overload of the power source.

Supra [1.c].

[40.] A power system as claimed in claim 39 wherein in b) the at least one loading parameter is a voltage of the output AC power.

Controller 300 (sensing circuit) responds to system voltage E (voltage of the output AC). EX1003, ¶128, ¶¶128-30. “The [P&Q] calculator 310 can calculate...real power $P_{[meas]}$ being injected by the microsource using the inductor current, $\bar{I}_{inductor}$.” EX1011, ¶[0077]. Figure 3 shows system voltage E input to calculator 310 that calculates P_{meas} :



POSITA would have understood, or found obvious, system voltage E is the voltage of the output AC power used with $\bar{I}_{inductor}$ to calculate P_{meas} (to which frequency control responds). EX1005, ¶[0077], ¶[0190], FIGS. 1-4, 12; EX1003,

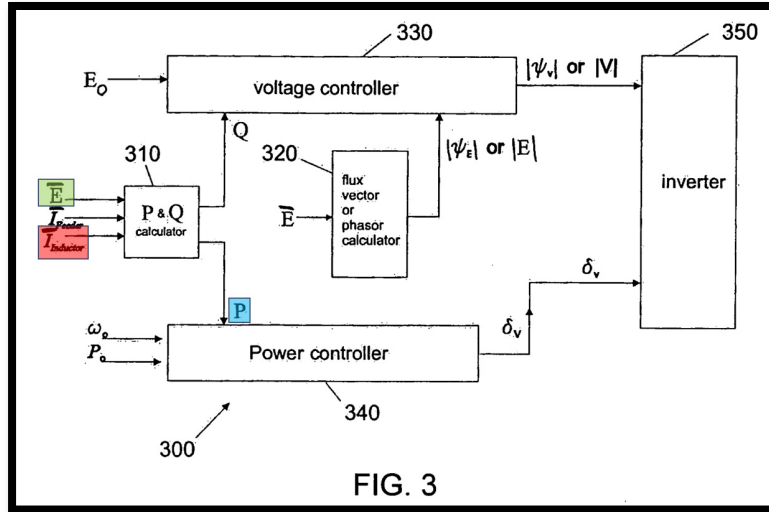
¶¶128-130 (citing EX1022, 63-64). Because controller **300** responds to P_{meas} to change frequency, *supra* [39.a]-[39.b]; [1.b], and P_{meas} changes based on system voltage E , controller **300** responds to *timely amount* of system voltage E (*voltage of the AC power*). EX1003, ¶¶128-129.

System voltage E is *timely* per the '857 patent—it is determined via “instantaneous voltage measurements,” *i.e.*, “instant, real time, close to real time or a suitable time.” EX1005, ¶[0075]. EX1003, ¶130. E is a *parameter*. *Supra* [13].

[41.] A power system as claimed in claim 40 wherein in a) the at least one power system parameter is an amount of voltage and when in b) the voltage of the output AC power is less than the voltage amount the frequency of the output AC power is controlled to have the second frequency.

System voltage E (*voltage of the output AC power*) is compared to *power-system parameter*, E_{P0} (*voltage amount* corresponding to P_0 at a given $\bar{I}_{inductor}$). EX1005, ¶[0075]; EX1003, ¶131, ¶¶131-37.

Controller **300** includes calculator **310**. EX1005, FIG. 3. “[C]alculator **310** can calculate...real power P being injected by the microsource using the inductor current, $\bar{I}_{inductor}$.” *Id.*, ¶[0077]. Figure 3 shows system voltage E as the voltage input to calculator **310** to calculate P_{meas} :

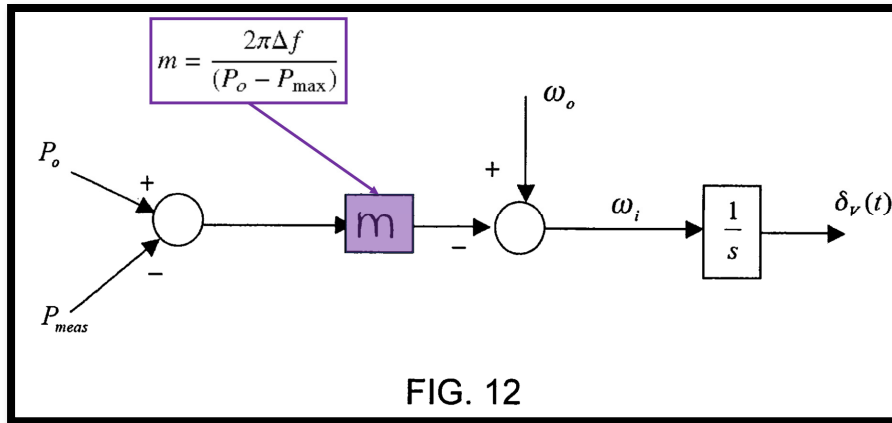


POSITA would have understood or found obvious to use **system voltage E**'s as *voltage of the output AC power* with $\bar{I}_{\text{inductor}}$ to calculate P_{meas} . EX1005, ¶[0077], [0190], FIGS. 1-4, 12; EX1003, ¶¶131-137 (citing EX1022, 63-64).

Moreover, POSITA would have understood P_0 and P_{max} *include voltage amounts* E_{P0} or E_{max} —thus, *power-source parameters corresponding to the maximum-output power*—for a given current $\bar{I}_{\text{inductor}}$. EX1003, ¶134 (citing EX1022, 63-64).

Controller **300** compares P_{meas} , P_0 , and **P- ω slope m** (function of P_{max} , EX1005, Eq. 9) to change frequency as shown in Equation 8 and Figure 12:

$$\omega_i = \omega_0 - m(P_0 - P_{\text{meas}}) \quad [\text{Eq. 8}]$$



Alternatively, P_{meas} and *power-source parameter* P_0 include *voltages* of the output AC power. P_{meas} and P_0 are compared. *Supra* [1.b].

[42.] A power system as claimed in claim 39 wherein in b) the at least one loading parameter is a current of the output AC power.

Supra [1.b]; *infra* [61.a] (I_{inductor} is a parameter).

[43.] A power system as claimed in claim 42 wherein in a) the at least one power system parameter is an amount of current and when in b) the current of the output AC power is greater than the current amount the frequency of the output AC power is controlled to have the second frequency.

Supra [1.b]; EX1003, ¶¶139-141. Although Lasseter describes P_{max} in terms of power, POSITA would have understood that at a given operating voltage, power and current are directly related. EX1003, ¶¶139-141 (citing EX1022, 63-64). Knowing P_{max} and operating voltage (like Lasseter) entails knowing corresponding maximum current, $\bar{I}_{\text{inductor}}$ at P_{max} , injected by the microsource. EX1003, ¶¶139-141. Thus, when Lasseter controls frequency, based on power, to be the second frequency, it does so when a current of output AC power is greater than current of

the power-system parameter. EX1003, ¶¶139-141; EX1005, ¶[0016].

[61.pre] A power system which provides AC power with one or more controlled power parameters to assist in managing the loading thereof, the power system comprising:

Supra [1.pre]. EX1003, ¶¶142-57. Lasseter discloses “control schemes for controlling the instantaneous frequency...from one or more microsources.” EX1005, ¶[0058]. That frequency (ω_i) is a ***controlled-power parameter***, per the ’857 patent, because it is a controlled “quantity of...[an] attribute” of the microsources—the sinusoidal AC waveform’s rate of oscillation, “treated as constant” throughout Lasseter. EX1003, ¶142. Though microsources change their frequency, “parameter[s] may at times change or be adjusted.” EX1001, 10:11-20.

[61.a] a non-utility type power source comprising an inverter which provides single or multiple phase output AC power to one or more of a plurality of loads, the power source having at least one maximum power source parameter which if exceeded for a specified period of time may cause a loss of output AC power or damage to the power source, the output AC power having one or more timely power parameter, including AC frequency, which may be changed;

Supra [1.a]. Lasseter’s “maximum output power,” $P_{\max}$, provides the ***maximum-power source parameter***. EX1003, ¶¶143-148. $P_{\max}$ is a parameter. *Supra* [1.a]. All microsources must have maximum-power parameters that ***if exceeded for a period of time*** may cause a ***loss of power or damage*** the microsource. EX1003, ¶143. POSITA would have understood the maximum-power to be Lasseter’s $P_{\max}$ or would have found it obvious to set $P_{\max}$ to that value. EX1003, ¶143.

Lopes employs load shedding because “high imbalance between local load and generation” (*exceeded*) for longer than a “certain time interval” (*specified period of time*) could *damage* a power source. EX1011; 11, 4; EX1003, ¶144.

The frequency-power parameter identified *supra* [61.pre] is *timely*, per the ’857 patent, because it is “instantaneous frequency,”—“instant, real time, close to real time or a suitable time.” EX1005, ¶[0058]. EX1003, ¶145. Frequency is “controlled” because it *may be changed*. *Id.*

Power output from the microsource (P_{meas}) is another *power parameter*, calculated from “instantaneous voltage [and] current measurements,” and is thus *timely*, per the ’857 patent—“instant, real time, close to real time or a suitable time.” *See* [1.a]-[1.b], [39.a]-[39.b]; EX1003, ¶¶146-147 (citing EX1022, 64). P_{meas} *may be changed*. *Id.* P_{meas} is a function of output frequency, so it *includes AC frequency*. EX1003, ¶¶146-147 ($P=VI*\cos(\phi)$).

“ I_{inductor} , the time varying current injected by the microsource” is another *power parameter*. EX1005, ¶[0075]. I_{inductor} is a parameter per the ’857 patent; it is “a quantity of” an output power “treated as a constant” throughout Lasseter’s calculations. EX1003, ¶148. Timely current is an ’857 patent express parameter example. EX1001, 10:11-20. I_{inductor} is *timely* per the patent—its measurements are “instant, real time, close to real time or a suitable time,” *id.*, given their use of “instantaneous current and voltage measurements” at inverter **230**’s/**350**’s output.

Id., ¶[0074]-[0077], FIGS. 3, 5 and 12; EX1003, ¶148.

[61.b] a power sensing circuit which may be part of the power source or otherwise and is responsive to the timely power parameter, the power source operating in response to the power sensing circuit and the maximum output power parameter to control the frequency of the output AC power to indicate the loading of the power source;

Supra [1.b], [39.b]. Microsource (the *power source*) *operates in response to* controller **300** (*power-sensing circuit*) to “reduce[] the operating frequency of the inverter to increase its unit output power” (*control the frequency of the output AC power*). EX1005, ¶[0015]; *supra* [1.b]. So, microsource *indicates* the power output (*the loading of the power source*) by changing frequency to reflect the load, e.g., “maximum output power” with “minimum operating frequency.” *Id.* EX1003, ¶¶149-156.

Controller **300** (*power-sensing circuit*) responds to *timely power parameters* I_{inductor} , P_{meas} , and frequency. *Supra* [61.a]; EX1003, ¶150. Calculator **310** of controller **300** calculates P_{meas} using $\bar{E}$ and I_{inductor} , and uses P_{meas} to determine the inverter’s output frequency (ω_i). *Supra* [1.b]. P_{meas} is a function of the output-power’s frequency. EX1003, ¶150. The power controller **340** of controller **300** changes output frequency (ω_i) based on P_{meas} and P - ω slope m :

$$\omega_i = \omega_0 - m(P_0 - P_{\text{meas}})$$

[Eq. 8]

Controller **300** responds to *maximum-output parameter* P_{max} . P - ω slope m “is

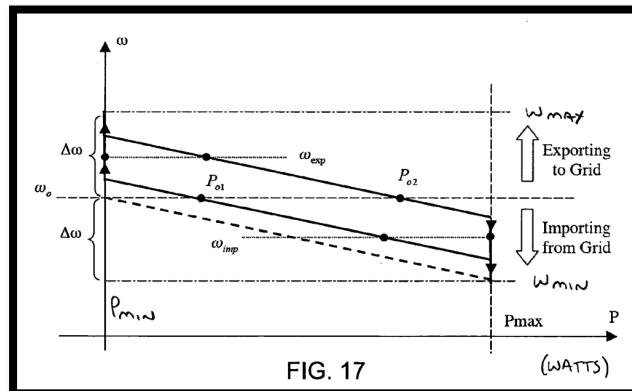
a function of...the maximum power output, $P_{\max}$,” (*maximum-output power parameter*) and frequency (f), EX1005, ¶[0112], per Equation 9:

$$m = \frac{2\pi\Delta f}{(P_o - P_{\max})} \quad [\text{Eq. 9}]$$

In each instance of FIGS. 14-15, 17, when P_{meas} reaches $P_{\max}$, controller **300**’s power controller **340** responds by setting the inverter to minimum frequency.

Thus, controller **300**’s (*power-sensing circuit*) power controller **340** also *operates in response* to $P_{\max}$ (*maximum-output parameter*).

Further, in FIG. 17, the relationships of Equations 8 and 9 hold until reaching $P_{\max}$, where “slope $[P-\omega]$ switches to vertical.” EX1005, ¶[0140], ¶¶[0138]-[0141]. Controller **300**’s (*power-sensing circuit*) power controller **340**—when employing FIG. 17—*operates in response* to $P_{\max}$ (*maximum-output parameter*) to make slope m vertical.

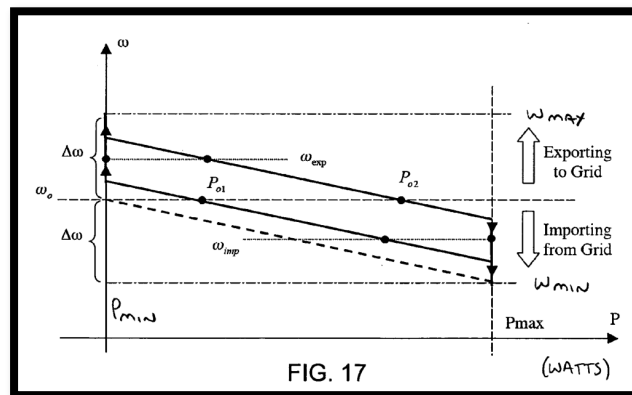
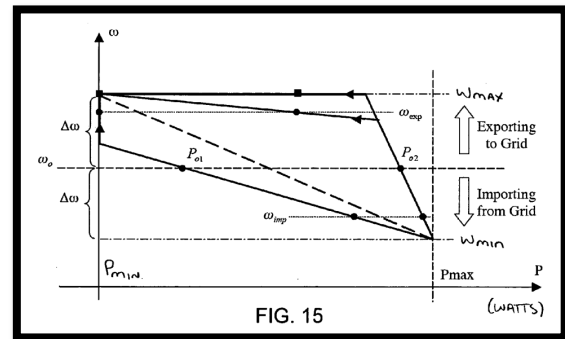
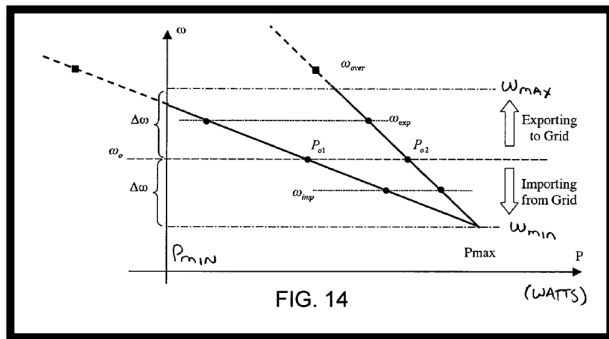


Microsource (*power source*) *operates in response* to controller **300** (*power-*

*sensing circuit) to control the frequency of the output AC power, which itself responds to **maximum-output parameter**.*

Changes in output frequency ω_i *indicate the loading of the power source*.

Figures 14-15, and 17 depict loading (indicated by changing frequency). EX1005, ¶¶[0033]-[0036], ¶¶[0110]-[0115], ¶¶[0121]-[0140].



POSITA would have understood, or found obvious, this frequency *indicates* loading—Lasseter teaches changing frequency to address changes in loading. EX1003, ¶¶151-156. Lopes' under-frequency relays function on the premise that frequency droops indicate overload at certain thresholds. EX1011, 4, 6; EX1003, ¶¶151-156.

[61.c] a processor circuit comprising one or more processors responsive to the frequency of the output AC power to control the coupling of power to at least one load of the one or more loads thereby helping to prevent or alleviate an overload of the power source.

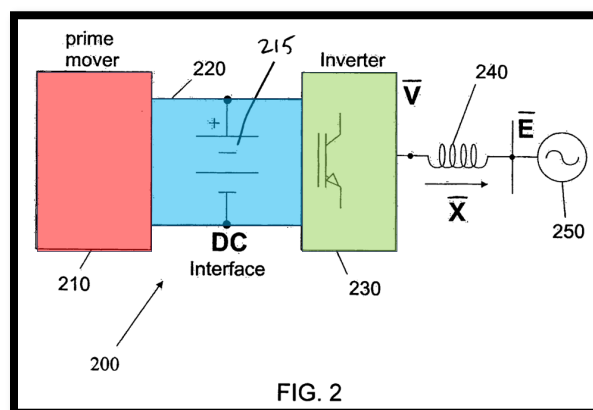
Supra [1.b]-[2]. Lopes' under-frequency relays (***processor circuit***) are ***responsive to the frequency of the output AC power***—they “shed[]” loads “based on the amplitude of frequency deviation” of the microsources (***power sources***). EX1011, 4-5; EX1003, 157. *See also* Part III.A.1.

[62.] A power system as claimed in claim 61 wherein the processor circuit of c) is a physically distinct device contained in its own enclosure and not physically part of the power source of a), the processor circuit c) being physically wired to the power source output to receive the output AC power, and physically wired to the at least one load of the one or more loads, the processor circuit operating to controllably couple power from the power source output to the at least one load.

Supra [2]. Lopes' LCs and under-frequency relays (***processor circuits***) are ***physically distinct***, located at the loads themselves. EX1011, 2-4, 6, FIG. 1. POSITA would have understood or found obvious (at least from Lasseter's enclosed switches **118** and/or EX1022, 454) that ***distinct*** processor circuits located at different loads would each have their ***own enclosures***. EX1003, ¶158; EX1005, FIG. 1 (switch **118** showing box enclosure); EX1022, 454 (“Enclosing the Circuit”). POSITA would have understood, or found obvious, the LCs and under-frequency relays are ***physically wired*** between microsources (***power sources***) and loads given the basic function of relays and load shedding generally—breaking the electrical connection in wires to halt flow of currents from power sources to loads. EX1003, ¶158.

[65.] A power system as claimed in claim 61 wherein in a) the one or more inverter is a DC to AC inverter and receives DC power from one or more of: i) a power grid; ii) a rechargeable power storage system; iii) a solar PV system; iv) another green renewable power system; v) an internal combustion power generator.

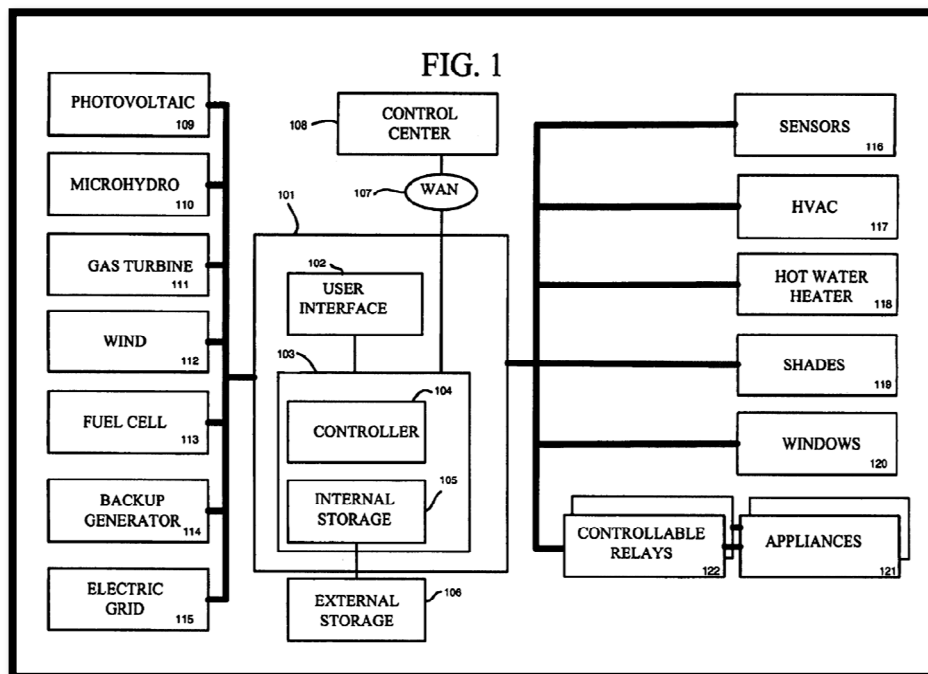
DC-to-AC inverter 230/350 can receive DC power from “power storage 215...a battery” (rechargeable power storage system), *supra* [5]-[6], or directly from “prime mover 210,” which can include a “PV” (solar PV system), or a “wind turbine” (other green renewable power system). EX1005, ¶[0070], FIG. 2; EX1003, ¶159. **Inverter 230/350** can receive DC power from an internal combustion power generator, *supra* [4] (an AC source that is “typically used to provide an intermediate DC voltage, that may...[be] produced indirectly from AC sources, for example by rectification”). EX1005, ¶[0010]. Moreover, “[p]ower storage for a microsource during island operation can come” from “use of local traditional generation” like the utility grid. EX1005, ¶[0068]; EX1003, ¶159.



**B. [GROUND 1B] – Claims 5-12, 16 Are Obvious Over
Lasseter-Lopes-Miller.**

1. Miller (EX1026)

Miller’s “integrated control device” “manages the supply of energy from various sources.” EX1026, 1:53-2:9. “An optimization algorithm” manages by “determine[ing] based on various factors when to activate the energy sources.” *Id.* “[T]he algorithm” takes “into account such factors as the supply of charge on batteries” or “the dynamic price of electricity...in order to schedule and activate energy supplies.” *Id.* FIG. 1 depicts a “system employing various principles of the present invention,” including “apparatus 101” that “includes a unit 103 comprising a controller 104 and an internal storage device 105.” *Id.*, 3:54-57.



Apparatus 101’s “internal storage device 105,” “comprise[s], for example, a

plurality of lead-acid or nickel-metal-hydride storage batteries for storing electrical energy.” EX1026, 2:54-61. Apparatus **101** includes “[c]ontroller **104**” programmed with “computer software for controlling the operation of apparatus **101** in order to receive electrical power from power sources **109** through **115**.” EX1026, 3:22-28. “During normal operation, power from one or more of the power sources can be used to charge storage units **105** and **106**.” EX1026, 4:4-12. Controller 104 is compatible with “electric utility grid **115**” and “alternative energy sources **109** through **113**” that “provide electrical power to the apparatus,” including “photovoltaic (PV) cells **109**,” “gas turbines **111**,” and “wind-based devices **112**.” EX1026, 3:56-4:3, FIG. 1.

Apparatus **101** manages energy use from power sources “to deliver power in the most efficient way, where efficiency is defined in terms of the amount of energy used, cost, or a balance of the two.” EX1026, 5:9-18. The system determines “marginal cost for each of a plurality of energy sources” including a “non-grid source” and “whether to store electrical energy in a battery,” “causing such storage.” *Id.*, [1], [23].

2. The Combination, Reasons to Combine, & Expectation of Success

POSITA would have recognized the benefit of combining Lasseter-Lopes with Miller—doing so would have been obvious. EX1003, ¶¶160-169. Lasseter

discloses a method of controlling microsource output frequency to alter its output power in response to changing loads, and Lopes adds a responsive under-frequency load-shedding scheme to maintain balance between generation and load. *Supra* Part III.A.1-3. While Lasseter-Lopes explains how one or more microsources can meet demand via frequency control and load shedding and contemplates batteries, *id.*, it does not describe how to control or select particular microsources for charging and discharging DER batteries. Thus, it would have been obvious to configure a microsource on Lasseter-Lopes' DER with an arrangement like Miller's "integrated control device" that "manages the supply of energy from various sources," EX1026, 1:53-62, and its rechargeable batteries, to coordinate grid and microsources to manage battery charging and discharging. EX1003, ¶160. Lasseter (via incorporation by reference, EX1005, ¶[0056]) even discloses a battery microsource. EX1020, ¶[0016] ("[T]here are two basic classes of microsources: DC sources, such as...battery storage.").

First, while Lasseter discloses using a battery as a microsource, *supra* Lasseter-Lopes [6]; EX1020, ¶[0016], Lasseter does not discuss charging. POSITA would have looked to Miller's solution—its "integrated control device"—to coordinate charging. EX1003, ¶161. Providing rechargeable battery microsources on Lasseter-Lopes' DER with the teachings from Miller's "integrated control device" would simply be "a combination of familiar elements according to known

methods,” (a rechargeable battery and control device used for intended purpose of supplying battery power to the DER and managing battery charging and discharging) to “yield predictable results”—*i.e.*, ensuring the rechargeable battery charges and can supply power to the DER. *KSR*, 550 U.S. at 401; EX1003, ¶161.

Second, POSITA looking to maximize multiple microsources (including microsources without a dedicated battery) would have been motivated to incorporate a rechargeable-battery microsource with a controller like Miller’s to enable battery-charging participation across all microsources, “deliver[ing] power in the most efficient way.” EX1026, 5:9-18, 7:25-37; EX1003, ¶162.

Third, POSITA would have been motivated to incorporate a rechargeable-battery microsource with Miller’s controller **104** to enable charging via other microsources, improving efficiency. EX1003, ¶163. Microsources enjoy “better efficiencies...at...higher operating points.” EX1005, ¶[0132]. Miller’s controller **104** in a rechargeable-battery microsource allows DERs to employ otherwise underutilized microsources for charging, improving efficiency under low-load conditions while storing energy for higher-demand periods. EX1003, ¶163.

Fourth, POSITA would have wanted to incorporate a rechargeable-battery microsource with Miller’s controller and “optimization algorithm[s]” in DERs to promote cost-effective charging. EX1026, 1:53-62; EX1003, ¶164. Miller addresses cost-effective battery charging strategies—e.g., deferring recharging until “later in

the day” when “[grid] costs are lower.” EX1026, 5:43-58. Combining Miller with Lasseter-Lopes ensures the system maintains frequency stability and minimizes purchased-energy cost—a recognized design objective for microgrids where energy costs fluctuate. EX1003, ¶164. Miller’s additional cost advantages—from selective charging using renewable sources, such as wind or solar, when such generation is available—would have motivated POSITA to combine Miller’s teachings with Lasseter-Lopes. EX1003, ¶164. POSITA would have recognized the benefits of charging batteries with inexpensive solar and wind energy when available, and of controlling charging to avoid more costly grid power. EX1003, ¶164.

Also, it would have been obvious for batteries in Lasseter-Lopes’ microsources, EX1005, ¶[0064], to be rechargeable and a controller provided for controlling recharging the batteries as taught by Miller, EX1026, 4:4-12. Should Lasseter not disclose rechargeable batteries (connected between a prime mover and inverter, *supra* Lasseter-Lopes [6]), POSITA would have been motivated to incorporate Miller’s teaching of rechargeable batteries and controller in Lasseter-Lopes’ DERs for the many rechargeable-battery benefits derived from using power storage over many cycles. EX1003, ¶165. Miller teaches exemplary “**storage batteries** for storing electrical energy” for which “power from one or more of the power sources can be used to charge,” and a controller that controls the recharging. EX1026, 2:54-61, 3:22-28, 4:4-12. POSITA would have been motivated to

incorporate rechargeable batteries (rather than single-use batteries) and a controller for controlling their recharging, because it would allow the battery to be used over many cycles and eliminate battery replacement needs. EX1003, ¶165. Lopes even says, “storage devices are absolutely essential to control strategies for MG operation in islanded mode,” EX1011, 8—POSITA would have recognized the importance of replenishing battery charge to prolong battery operation beyond one charge. EX1003, ¶165.

POSITA would have reasonably expected success in the combinations. EX1003, ¶166. They merely apply Miller’s teachings of “integrated control device[s]” that “manage[] the supply of energy from various sources,” EX1026, 1:53-62, to known microsource configurations as in Lasseter-Lopes. EX1003, ¶166. Each element—controllers, rechargeable batteries, and various power sources—was well-known and used in systems before the relevant date. EX1003, ¶166. Implementing control that Miller teaches in Lasseter-Lopes’ DERs would simply involve exchanging control signals between known interfaces and using known techniques to dispatch sources for charging, yielding predictable and reliable operation. EX1003, ¶166.

The combinations augment, rather than change, Lasseter-Lopes’ operating principle. Operating normally, Lasseter-Lopes would continue managing local power balance through frequency and load control, and Miller would coordinate

recharging of batteries through its controller/algorithm. During surplus generation, Miller would store or export power—functions expressly contemplated by Lasseter and Lopes. EX1005, ¶¶[0110]-[0115] (export), ¶[0010], ¶¶[0064]-[0070] (battery); EX1011, 7-8. Using Miller’s charging logic in Lasseter-Lopes’ frequency-based control is therefore “a combination of familiar elements according to known methods” to “yield predictable results.” *KSR*, 550 U.S. at 416; EX1003, ¶167.

Combining Lasseter-Lopes with Miller would have been nothing more than integrating Miller’s well-known battery management techniques (charging and power source coordination) with Lasseter-Lopes’ controlled under-frequency load-shedding scheme, all addressing the same power-system technology—power systems that integrate with a utility grid. EX1003, ¶168. The fundamental aspects of Lasseter’s frequency-manipulated microsources, strengthened by Lopes’ load-shedding and Miller’s battery-charging coordination, result in a reasonable expectation of success. EX1003, ¶168-169.

3. Claim Element Analysis

[5.] A power system as claimed in claim 1 wherein the inverter is responsive to at least one rechargeable battery to provide the output A.C. power.

Supra Lasseter-Lopes [5]; EX1003, 170-71. Miller discloses storage units 105 and 106. EX1026, 2:54-61. “[A]pparatus 101 includes...internal storage device 105,” comprising “lead-acid or nickel-metal-hydride storage batteries for storing electrical energy.” EX1026, 2:54-61. “During normal operation, power from

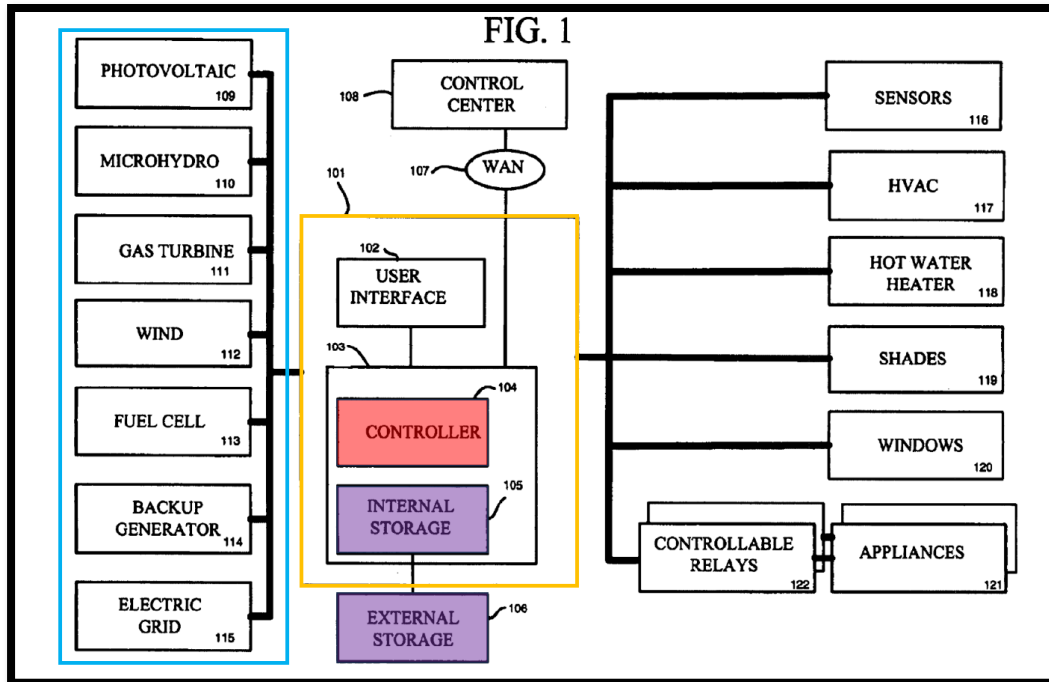
one or more of the power sources can be used to *charge storage units 105 and 106.*”

EX1026, 4:4-12.

Lasseter’s “microsource **200** may also include power storage **215**, for example a battery.” EX1005, ¶¶[0070]-[0071], ¶[0010], ¶[0064]. When employing Miller’s rechargeable-battery teachings in Lasseter’s microsource batteries, Lasseter’s *inverter is responsive to the rechargeable batteries*, generating AC power from the battery’s DC power because Miller’s rechargeable batteries are the “DC Interface” outputting power to inverter **230/350**. *Id.*; EX1003, ¶¶170-171; EX1026, 3:18-21; *supra* Lasseter-Lopes [5].

[6.] A power system as claimed in claim 5 wherein the power system controls the charging of the at least one rechargeable battery.

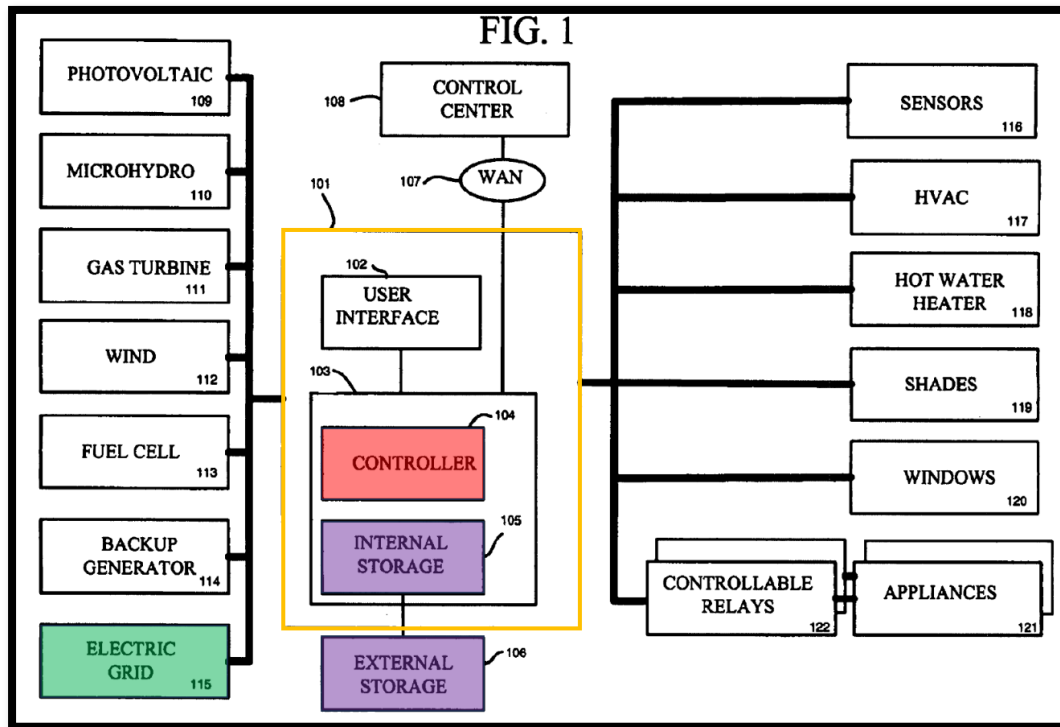
Controller 104 “*control[s]* the operation of **apparatus 101** to *receive electrical power* from **power sources 109** through **115**.” EX1026, 3:22-28. “[P]ower from one or more of the *power sources can be used to charge storage units 105 and 106.*” *Id.*, 4:4-12. When deploying Lasseter power storage 215 as a rechargeable-battery, a **controller 104** *controls the charging of* Lasseter’s *rechargeable batteries* from Lasseter’s microsources. EX1003, ¶172.



[7.] A power system as claimed in claim 6 wherein the power system controls the charging of the at least one rechargeable battery from a power grid.

Controller 104 “control[s] the operation of **apparatus 101** to receive electrical power from **power sources 109** through **115**.” EX1026, 3:22-55; 4:4-15, FIG. 1. “Controller **104**...make[s] decisions regarding control and distribution of electricity.” *Id.* “[P]ower from...the power sources can be used to charge **storage units 105** and **106** and/or to meet demand in addition to **electric grid 115**.” *Id.* Because “[t]he bold lines shown in FIG. 1 indicate electrical distribution paths” and **electric grid 115** is connected via bold line to **apparatus 101** (containing **batteries 105** and **106**) **controller 104** controls the charging from a power grid. The same would be true in Lasseter-Lopes-Miller—Lasseter describes its “microsources []

importing power from the grid.” EX1005, ¶[011]; EX1003, ¶173.



[8.] A power system as claimed in claim 6 wherein the power system controls the charging of the at least one rechargeable battery from at least one solar panel.

Supra Lasseter-Lopes [8] (solar panels). Controller 104 is compatible with and can control “alternative energy sources 109 through 113” in Figure 1 that “provide electrical power to the apparatus,” which “include *photovoltaic (PV) cells* 109.” EX1026, 3:56-4:3, FIG. 1. The same would be true in Lasseter-Lopes-Miller and Lasseter’s solar panels. EX1003, ¶174.

[9.] A power system as claimed in claim 6 wherein the power system controls the charging of the at least one rechargeable battery from a non-grid internal combustion powered electrical power source.

Supra Lasseter-Lopes [4] (internal combustion power source). Miller’s

controller **104** can control gas turbine **111** for charging batteries **105/106**. EX1026, 4:4-12, FIG. 1. Miller teaches the same for backup generator **114**. EX1026, 175, FIG. 1. The same would be true in Lasseter-Lopes-Miller, with controller controlling Lasseter's *internal combustion* microsources. EX1003, ¶175.

[10.] A power system as claimed in claim 6 wherein a power grid and at least one solar panel are available to charge the battery and the power system controls the selection of at least one of the power grid and the at least one solar panel to charge the at least one rechargeable battery.

Supra [6] (controls battery charging); [7] (power grid); [8] (solar panel); EX1003, ¶176.

[11.] A power system as claimed in claim 6 wherein a power grid and a non-grid internal combustion powered electrical power source are available to charge the at least one rechargeable battery and the power system controls the selection of at least one of the power grid and the non-grid internal combustion powered electrical power source to charge the at least one rechargeable battery.

Supra [6] (controls battery charging); [7] (power grid); [9] (internal combustion power source); EX1003, ¶177.

[12.] A power system as claimed in claim 6 wherein a power grid, a solar panel array and a non-grid internal combustion powered electrical power source are available to charge the at least one rechargeable battery and the power system controls the selection of one or more of the power grid, the solar panel array and the non-grid internal combustion powered electrical power source to charge the at least one rechargeable battery.

Supra [6] (controls battery charging); [7] (power grid); [8] (solar panel); [9] (internal combustion power source); EX1003, ¶178.

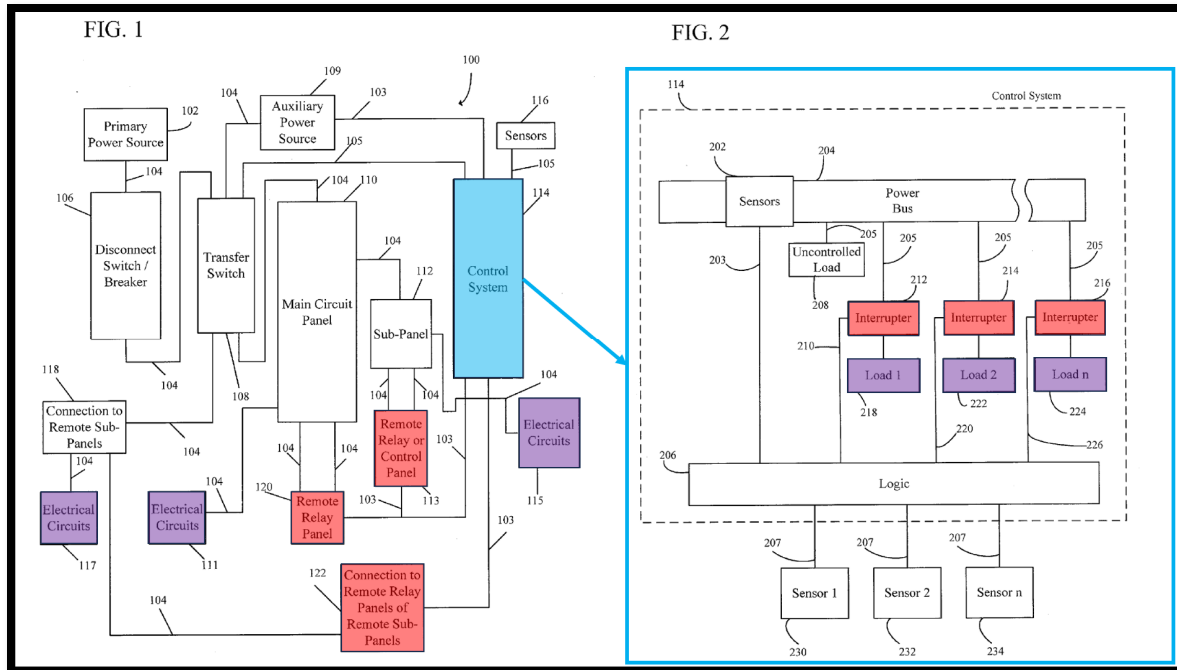
[16.] A power system as claimed in claim 5 further including a transfer switch which may output power from a power grid or from the power source to provide power to the one or more of a plurality of loads, the power system operating to charge the at least one rechargeable battery from the power grid via the transfer switch output when the transfer switch outputs grid power, with the power system stopping the charging of the at least one rechargeable battery via the output of the transfer switch when the transfer switch outputs power from the power source to provide power to the one or more of a plurality of loads.

Supra Lasseter-Lopes [13]-[15]; Lasseter-Lopes-Miller [5]-[6]; EX1003, ¶179.

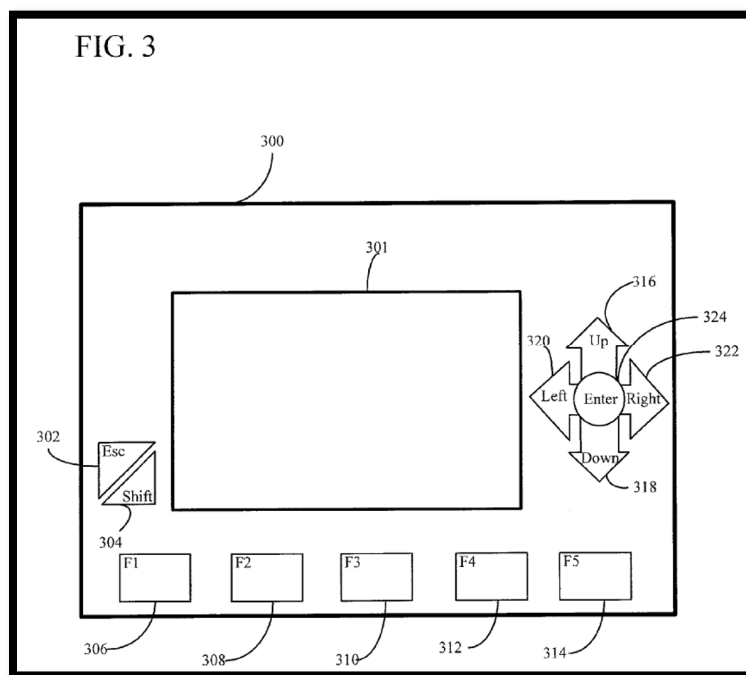
C. [GROUND 1C] – Claims 13, 44, And 63-64 Are Obvious Over Lasseter-Lopes-Baldassarre.

1. Baldassarre (EX1021)

Baldassarre’s control system 114 controls loads powered by auxiliary power sources after utility-power interruptions. EX1021, Abstract, ¶[0016], ¶[0023], ¶[0096]. Baldassarre manages electrical loads through current interrupting relays, connecting and disconnecting loads responsive to power-source conditions. EX1021, ¶[0058], ¶[0090], FIGS. 1-2. The “current interrupters” are “in series electrical connection with loads” and power source. EX1021, ¶[0090], FIGS. 1-2.



Baldassarre discloses user interactive device **300**, allowing users to program load priorities and sequence load shedding and reconnection. EX1021, ¶¶[0075]-[0076], ¶¶[0095]-[0103], ¶[0108].



2. The Combination, Reasons to Combine, & Expectation of Success

Because POSITA would have recognized the benefits of combining Lasseter-Lopes with Baldassarre, it would have been obvious. EX1003, ¶¶180-188; ¶¶355-56. As discussed, Lasseter-Lopes discloses microsources that vary output frequency responsive to loading, automatically shedding loads via LCs and under-frequency relays. *Supra* Part III.A.3. Though Lopes discusses shedding loads based on relative importance (shedding different amounts of loads “based on the amplitude of frequency deviation”) and reconnecting loads gradually, EX1011, 3-6, Lopes does not discuss implementation, hardware, or a user-interface for setting load priorities. Baldassarre supplements Lopes, disclosing a processor-based control system with a user interface that automatically disconnects and restores loads based on user-defined priorities and real-time system conditions. EX1021, ¶¶[0075]-[0103], FIG. 3. POSITA would have been motivated to combine Baldassarre’s priority-based load-management control—including its user interface, load priorities and time and sequenced disconnect/reconnection of loads—with the Lasseter-Lopes system to enable user control of load-shedding critical and non-critical loads. EX1003, ¶181. Lopes’ load-shedding control could be augmented with Baldassarre’s load-management control, or Baldassarre’s load-management control implemented in place of Lasseter-Lopes’ adjusted, as needed, to accommodate Lasseter-Lopes’ system. EX1003, ¶181.

First, Lasseter-Lopes provide the control logic—frequency deviation and load-shedding thresholds—but not how users specify load-shedding or reconnection priority. POSITA would have looked to Baldassarre’s control system, including its user interface and load-priority programming, as an obvious solution—providing hardware and software structure for setting load priorities, implementing time-based reconnection, and sequentially restoring power. EX1021, ¶¶[0056]-[0058], ¶¶[0061]-[0065], ¶¶[0083]-[0089], ¶¶[0093]-[0109], ¶¶[0121]-[0127], FIGS. 1, 5-7; EX1003, ¶182. Integrating Baldassarre’s user interface with Lasseter-Lopes’ distributed controllers yields a system that not only sheds loads automatically when frequency drops, but does so according to priorities set by a user—a desirable improvement for any DER with load-shedding capabilities. EX1003, ¶182. Incorporating these aspects of Baldassarre into Lasseter-Lopes would simply be “a combination of familiar elements according to known methods,” (applying load-control systems with user interfaces and load-priority logic), to “yield predictable results,”—a load-shedding system allowing for user-definable priorities. *KSR*, 550 U.S. at 401; EX1003, ¶182.

Second, POSITA would have been motivated to combine Lasseter-Lopes with Baldassarre because Baldassarre solves a problem Lasseter-Lopes leaves unaddressed: conventional systems could not “continuously update the priorities of particular electrical loads in real time” or “allow a user to select in real-time which

loads are essential.” EX1021, ¶[0007]. Combining Lasseter-Lopes’ frequency control and frequency-based load shedding with Baldassarre’s user-configurable interface enables user-tailored load-shedding schemes—avoiding the inflexibility of fixed frequency thresholds, improving system usability, efficiency, and safety. EX1003, ¶183.

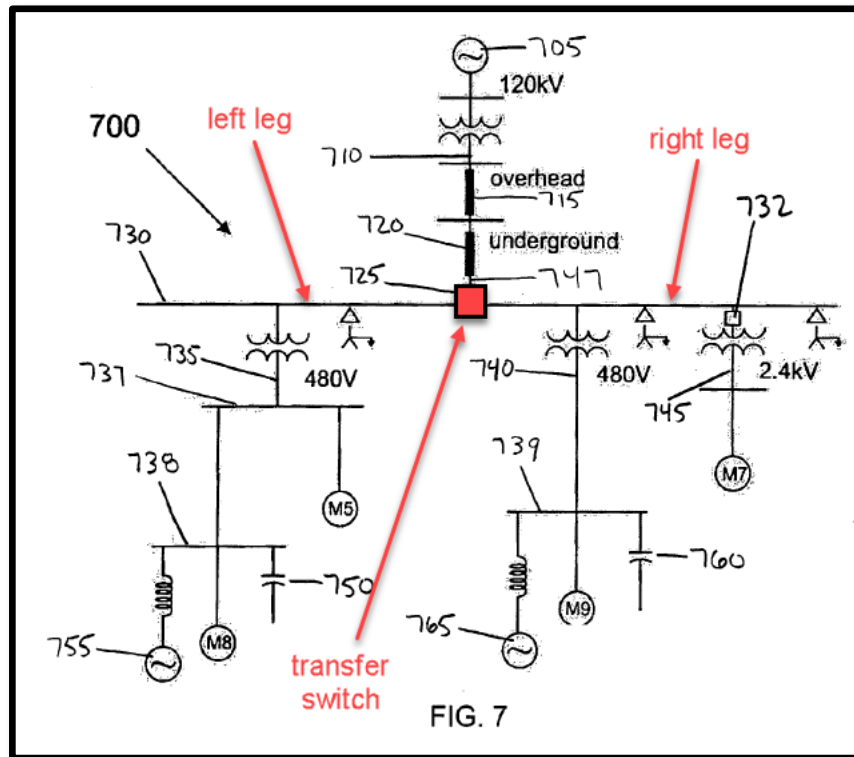
Third, implementing Baldassarre’s control system 114 with the LCs and under-frequency relays of Lasseter-Lopes would have been straightforward and predictable. EX1003, ¶184. Lopes’ LCs and under-frequency relays would function as frequency-responsive devices that open at predetermined-frequency deviations, and Baldassarre’s control systems would provide a user-programmable means for managing and coordinating those relays. EX1021, ¶¶[0094]-[0104], ¶¶[0110]-[0119]; EX1003, ¶184. Through Baldassarre’s processor-based controller and user-interactive device, users define load priorities, specify load-shedding conditions, and specify load restoration sequences. EX1021, ¶¶[0021]-[0027], ¶¶[0032]-[0034], ¶[0056], ¶¶[0090]-[0095]. POSITA would have recognized integrating this control scheme with Lopes’ distributed load controllers (LCs) and under-frequency relays would enable user-determined prioritization of load shedding without altering the basic LC/relay operation, while eliminating the need to configure each individually at its respective load site. EX1003, ¶184. This approach is a predictable combination of known microprocessor-based control systems to achieve improved coordination

and configurability in managing frequency-responsive load shedding. *KSR*, 550 U.S. at 417.

Fourth, POSITA would have been motivated by Baldassarre's additional benefit: real-time adjustment of load priorities. EX1021, ¶¶[0016], ¶[0030], ¶[0053], ¶[0081], ¶[0103]. While Lasseter-Lopes discloses relative load importance, EX1011, 4, it does not disclose *when* the importance is implemented. Because a user's needs change, POSITA would have employed Baldassarre's user interfaces to permit users to change load priorities as desired. EX1003, ¶¶185-185.

POSITA would have reasonably expected success. EX1003, ¶186. Each reference addresses managing power sources to maintain stable operation when loads vary. Lopes even contemplates "adopt[ing] standard protocols and open technologies...using off-the-shelf, low-cost, widely available, and fully-supported hardware and software components." EX1011, 2. Baldassarre's controller performs conventional relay switching using processor logic, while Lasseter-Lopes' control systems already use microcontrollers and relay-based load interfaces. EX1021, ¶186; EX1011, ¶[0025], ¶¶[0090]-[0091]. Integrating Baldassarre's programmable interface and relay hardware with Lasseter-Lopes' load-shedding control logic would have required only routine design adaptation and would predictably improve functionality: user-configurable, frequency-responsive load management in DERs. EX1003, ¶186.

Also, POSITA would have found it obvious to incorporate Baldassarre's multi-terminal transfer switch in Lasseter-Lopes, such as at the connection between utility supply feeder and the two legs of the power bus (*e.g.*, utility supply feeder **710** and left and right legs of power bus **730** of FIG. 7), enabling switching between utility supply and the power bus legs. POSITA would have been motivated to use the multi-terminal transfer switch because it is one of few ways to connect utility supply to a power bus with a transfer switch. EX1003, ¶187. POSITA would also have been motivated knowing that this configuration would allow one leg of the bus to operate normally in connecting/disconnecting from the grid at the switch while allowing the other leg to be not used, either by being disconnected from the switch or not selected via the switch, such as for safe maintenance/construction of the leg and the microsources and loads connected to it. *Id.* POSITA would have had a reasonable expectation of success because it is simply “a combination of familiar elements according to known methods,” (applying a multi-terminal switch between multiple power paths), to “yield predictable results”—a switch operating to select power paths. *KSR*, 550 U.S. at 401; EX1003, ¶¶187-188.



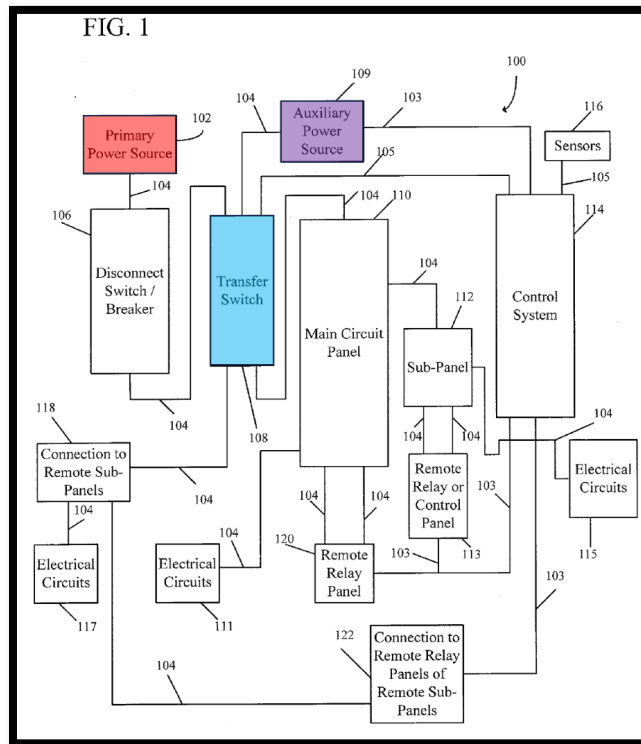
EX1005, FIG. 7.

3. Claim Element Analysis

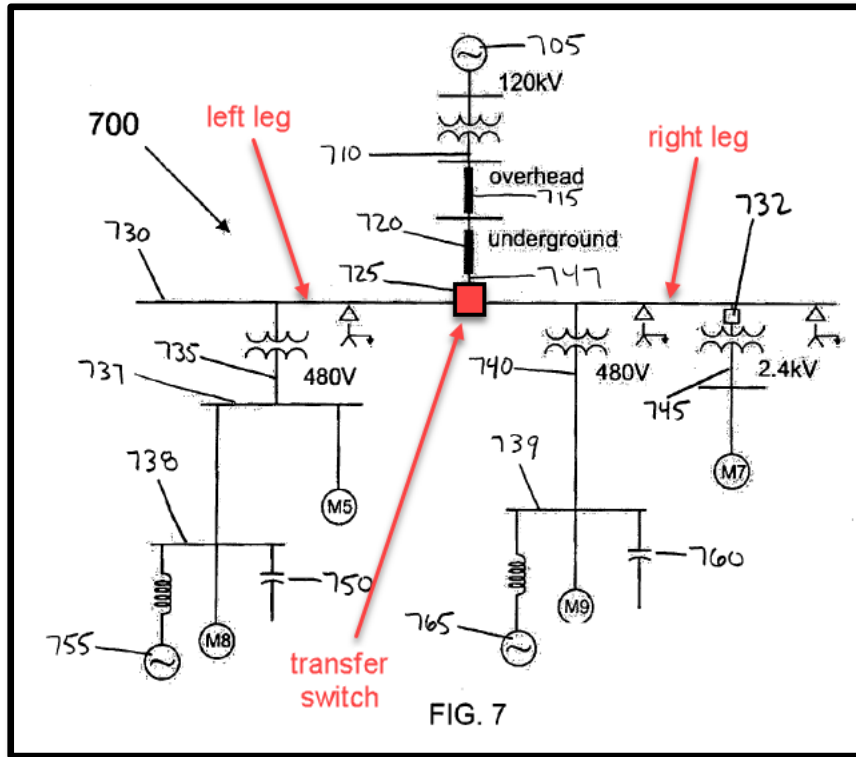
[13.] A power system as claimed in claim 1 further including a transfer switch which may select a power grid or the power source to provide power to the one or more of a plurality of loads, the transfer switch outputting power from the grid power meets acceptable parameters and to output power from the power source when the grid power does not meet acceptable standards.

Supra Lasseter-Lopes [13]. POSITA implementing transfer switches would have looked to Baldassarre. EX1003, ¶¶189-190. Baldassarre’s “automatic *transfer switches* are controlled using relay logic, programmable logic controllers (PLCs), embedded controllers” and select between *primary power source 102* and *auxiliary power source 109*. EX1021, ¶[0011], [0024], [0088]; FIG. 1. Baldassarre’s transfer

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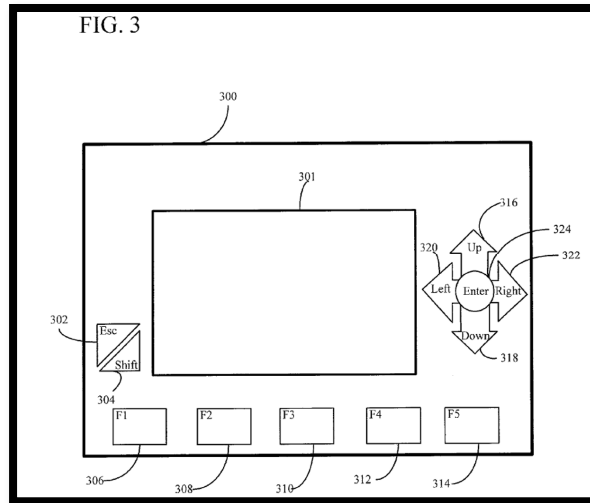
A transfer switch in Lasseter with multiple terminals, as in Baldassarre, connecting utility supply (feeder line **710**) and the two legs of the power bus **730** and operating following Lasseter (*supra* §III.A.4, [13]) would *output power from the grid power when it meets acceptable parameters* (power from utility supply to power bus) and *output power from the power source when the grid power does not meet acceptable standards* (power from left leg of the power bus to loads on right leg and vice versa).



EX1005, FIG. 7.

[44.] A power system as claimed in claim 39 wherein in c) the processor circuit operates to disconnect output AC power from the at least one or more loads for at least a time period which is responsive to a load priority which is selected via a user interface.

Lopes provides LCs and under-frequency relays (*processor circuits*) that *disconnect output AC power* from *loads*. *Supra* Lasseter-Lopes [1.c]-[2]. POSITA would have been motivated to employ a user programmable load disconnect/reconnect strategy—like Baldassarre’s control system **114** and user interactive device **300**—to control Lopes’ LCs’ or under-frequency relays’ operating parameters. *Supra* Part III.C.2; EX1003, ¶¶191-192. Baldassarre’s “user interactive device **300** is a graphical *user interface*.” EX1021, ¶[0097], ¶¶[0075]-[0103],



“[U]ser interactive device **300** is used for controlling control system **114**.” EX1021, ¶[0076], ¶¶[0082]-[0083], FIGS. 1-3. After a *time period* wherein “control system **114** determines that the generator power source is below its middle and/or maximum threshold, control system **114** automatically *restores the loads*.” EX1021, ¶[0103]. “[T]he user can program the microprocessor to...restore the various controlled loads in any desired sequence.” EX1021, ¶¶[0095]-[0098]. Because loads are reconnected in sequence selected via user interactive device **300**, loads are disconnected for *a time period which is responsive to a load priority*. EX1003, ¶¶191-92.

[63.pre] A power system as claimed in claim 61 wherein the processor circuit of c) is a physically distinct device contained in its own enclosure and not physically part of the power source of a), the enclosure containing:

Supra Lasseter-Lopes [62]; EX1003, ¶193-201.

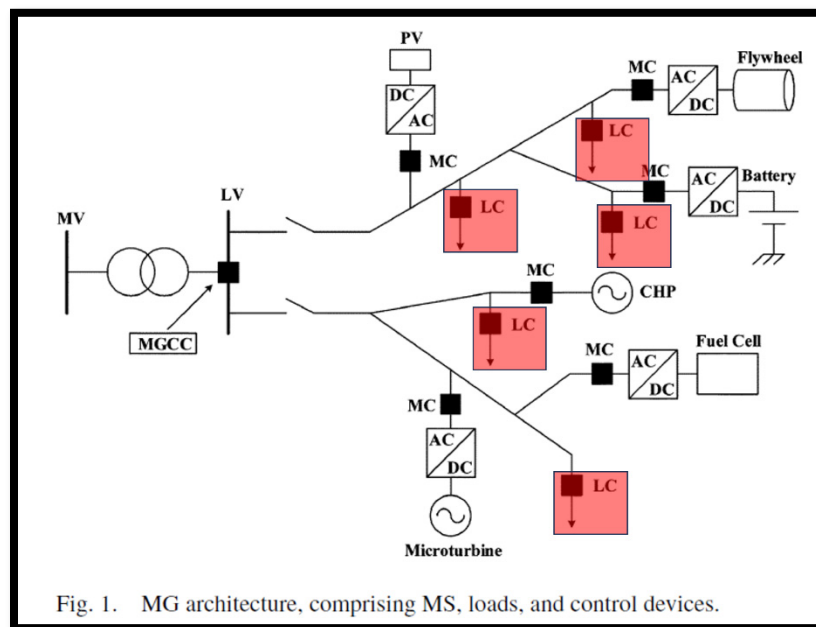
[63.d] a printed circuit assembly on which at least the one or more processor and supporting circuitry is mounted;

Given the '857 patent does not discuss PCBs or printed circuit assemblies, POSITA would have understood, or found obvious (e.g., in view of EX1022, 454 (“Enclosing the Circuit”)), Lopes’ under-frequency relays LCs and Baldassarre’s controllers (*processors*) and *supporting circuits* are *mounted* on *printed circuit assemblies*, and in their *own enclosures*—standard microcontroller-based control systems are ordinarily realized on PCBs, which are typically provided within protecting enclosures. EX1003, ¶194 (citing EX1022, 454); EX1011, 4, 6; EX1021, ¶¶0025], ¶¶0090], ¶¶0085], ¶¶0096]-[0103], ¶¶0108] and Lopes “adopt[s] standard protocols and open technologies...using off-the-shelf, low-cost, widely available, and fully-supported hardware and software.” EX1011, 2; EX1003, 194.

[63.e] at least one electrically controlled electro-mechanical switch, relay or contactor with one or more input electrical terminals via which it may be physically wired to the power source output to receive the output AC power, and one or more load electrical terminals via which it may be physically wired to the at least one load of the one or more loads and at least one control electrical terminal which is connected to the printed circuit assembly in order that the one or more processor can control connecting the output AC power to the at least one load via the input electrical terminals and the load electrical terminals;

Lopes depicts LCs in line with loads. EX1011, 2, FIG. 1; EX1003, ¶¶195-99. Because “LC serve as interfaces to control loads through the application of an interruptibility concept,” EX1011, 2, POSITA would have understood, or found obvious, LCs are, include, or control *electrically controlled* switches, relays or

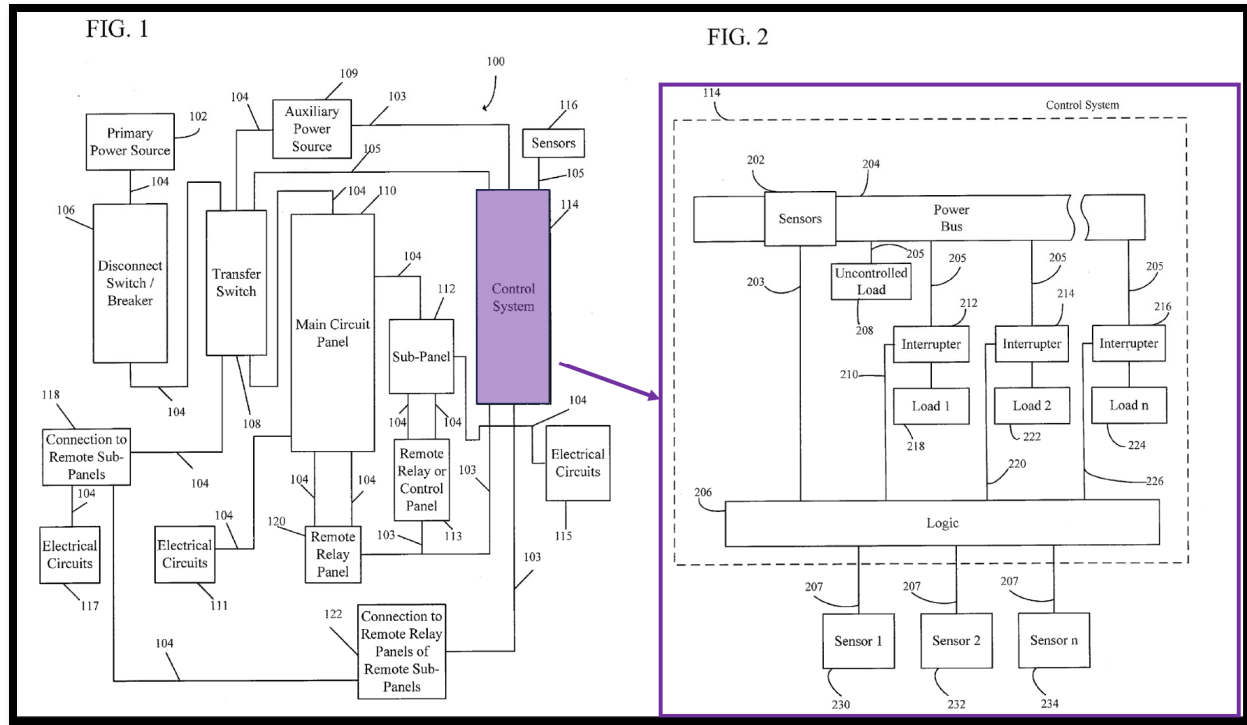
contactors that break load-source connections. EX1003, ¶195. Lopes' under-frequency relays effectuate load "temporary disconnection," and so are, or include, *electrically controlled* relays. EX1011, 4; EX1003, ¶195. POSITA would have understood, or found obvious, "disconnect[ing]" or "interrupt[ing]" indicates the switches, relays, or contactors have *input electrical terminals physically wired* to the microsource outputs to receive AC power and *load electrical terminals physically wired to loads*. EX1003, ¶195. Indeed, as in FIG. 1—power flowing through physically-wired terminals is what is disconnected. EX1011, 1-2; EX1003, ¶195.



POSITA would have understood, or found obvious, Lopes' LCs' and under-frequency relays' *printed circuit assemblies* have *control electrical terminals* allowing the LCs and relays to *control connecting the output AC power to the loads*.

EX1003, ¶196. LCs—“controllers located at loads”—are on distribution lines. EX1011, 2; EX1003, ¶196. Delivering power over long distances produces losses, requiring costly installation, and relays are electrically-actuated switches: POSITA would have understood, or found obvious, power is delivered via the line they disconnect rather than a distant source. EX1003, ¶196 (citing EX1022, 108-12).

Also, POSITA implementing LC or load-shedding relays would have looked to Baldassarre and found obvious to implement Lopes’ LC’s or relays as, or similar to, Baldassarre’s current interrupters. POSITA would have found motivation in Baldassarre as an example having “[d]etailed illustrative embodiments” and with stated advantages. EX1021, ¶[0046], [0052]-[0056]; EX1003, ¶197. Baldassarre’s FIG. 2 depicts control system **114**, including *electrically controlled electro-mechanical relays* called “current interrupters **212**, **214**, and **216**” or “relays.” EX1021, ¶[0090], ¶¶[0086]-[0091]; EX1003, ¶197. The interrupters/relays have *input electrical terminals* connecting to power-source outputs and *load electrical terminals* for delivering output power to loads **218**, **222** and **224**—“power bus **214** supplies power to interrupters **212**, **214**, and **216** via electrical wires **205**,” and interrupters **212**, **214**, and **216** “are in series electrical connection with loads **218**, **222** and **224**.” *Id.* POSITA would have understood, or found obvious, relays or interrupters connected in series between power sources and loads have input and load terminals. EX1003, ¶197.



“[C]ontrol system 114 may be coupled to...at least one sub-panel via electrical wires 104” (*control electrical terminal*). EX1021, ¶[0089]. POSITA would have understood, or found obvious, these wires connect relays to processor-based control circuitry, enabling the controller to actuate relays while minimizing wiring complexity. EX1003, ¶198. Via this terminal, control system 114 “may manage the controlled loads, which may be located in circuit panels, sub-panels, and/or remote sub-panels via relays.” EX1021, ¶[0091], ¶[0086]. When shedding loads, “control system 114 sends a signal,” and relays start “breaking (e.g., deactivating the load) the connection from the auxiliary power source to the load.” EX1021, ¶[0094]. The same is true of Lasseter-Lopes-Baldassare.

[63.f] a power supply receiving the output AC power of d) and providing DC power for the one or more processors, the power supply circuit being partially or totally mounted on the printed circuit board or otherwise;

Lopes and Baldassarre disclose processor-based control systems (LCs/under-frequency relays and interrupters/relays of **114**, respectively) for managing relays and loads. EX1011, 4, 6; EX1021, ¶[0086], ¶¶[0090]-[0094]. POSITA would have understood, or found obvious, such control systems require regulated DC supply to power its processor and logic circuitry, for microprocessors cannot operate on AC mains. EX1003, ¶¶199-200. It would have been obvious to implement a conventional AC/DC conversion circuit receiving AC power already supplied to the control system because this provides a simple, reliable source of DC power without requiring separate auxiliary feeds. *Id.*

Moreover, it was routine to mount power-supply components on printed-circuit assemblies containing the processor. EX1003, ¶200 (citing EX1022, 450-51). Off-the-shelf PCB-mount AC/DC converters were widely available, and it would have been an obvious design choice (e.g., at least in view of EX1022, 450-51) to integrate such components partially or totally on the control system PCB to minimize wiring and improve reliability. *Id.*; EX1011, 2.

[63.g] a user interface circuit being partially or totally mounted on the printed circuit or otherwise, the user interface providing information to a user or installer and providing the capability to enter a priority for the at least one load of e).

Supra [44]. In the combination, Baldassarre's interactive system **300 provides**

information to a user, for it “may contain a display (e.g. Screen) for interaction with a user and visually displaying the current demand of at least one load within the system.” EX1021, ¶[0108], ¶¶[0075]-[0103], FIG. 3. POSITA would have understood the system **300** to be a circuit. EX1003, ¶201.

[64.pre] A power system as claimed in claim 61 wherein there are a plurality of processor circuits of c) the power system comprising: a plurality of processor circuits of c) each being a physically distinct device contained in its own enclosure and not physically part of the power source of a) or other processor circuits c), each enclosure containing:

Supra Lasseter-Lopes [62]. Lopes discloses a plurality of “under-frequency relays” and LCs (processor circuits). EX1011, 4, 6; EX1003, ¶¶202-206.

[64.d] a printed circuit assembly on which at least the one or more processor and supporting circuitry is mounted;

Supra [63.d]

[64.e] at least one electrically controlled electro-mechanical switch, relay or contactor with one or more input electrical terminals via which it may be physically wired to the power source output to receive the output AC power, and one or more load electrical terminals via which it may be physically wired to the at least one load of the one or more loads and at least one control electrical terminal which is connected to the printed circuit assembly in order that the one or more processor can control connecting the output AC power to the at least one load via the input electrical terminals and the load electrical terminals;

Supra [63.e]

[64.f] a power supply receiving the output AC power of d) and providing DC power for the one or more processors, the power supply circuit being partially or totally mounted on the printed circuit board or otherwise;

Supra [63.f]

[64.g] a user interface circuit being partially or totally mounted on the printed circuit or otherwise, the user interface providing information to a user or installer and providing the capability to enter a priority for the at least one load of e).

Supra [63.g].

D. [GROUND 1D] – Claim 16 is Obvious Over Lasseter-Lopes-Baldassarre-Miller

1. The Combination, Reasons to Combine, & Expectation of Success

The motivations for combining Baldassarre and Miller with Lasseter-Lopes also apply when collectively combined. EX1003, ¶¶207-209. Baldassarre contributes transfer-switch hardware capable of routing power from the grid or auxiliary power source. *Supra* Part III.C.2. Miller contributes an “integrated control device” that “manages the supply of energy from various sources” like the grid. EX1026, 1:53-62, FIG. 1. “[P]ower from one or more of the power sources can be used to charge storage units **105** and **106**.” EX1026, 4:4-12. *Supra* Part III.B.2. POSITA would have recognized these features are complementary: Baldassarre’s transfer switch determines which source (grid or auxiliary) supplies the load, while Miller’s controller determines when and how to charge batteries based on the sources. EX1003, ¶207. Integrating these in Lasseter-Lopes would predictably allow batteries to charge from the grid when grid power is available and to cease charging when the transfer switch isolates the grid and connects auxiliary power sources—thereby conserving backup power for supplying loads. EX1003, ¶207.

POSITA would have understood this combination improves system reliability and efficiency without altering Lasseter-Lopes' underlying principles. EX1003, ¶208. Already, Baldassarre's transfer switch provides the mechanism for selecting between grid and auxiliary power outputs, and Miller's charging control governs when charging should occur depending on system state. By linking Miller's charging logic to Baldassarre's switching condition—charging when the switch outputs grid power and stopping charging when it outputs auxiliary power—the system ensures backup power output is conserved during grid outages and grid energy is utilized for charging where possible. EX1003, ¶208. This applies familiar battery-management control to an existing grid-transfer switch, yielding a straightforward, desirable result: automatic, condition-based control of charging consistent with practical backup power system design principles. *KSR*, 550 U.S. at 401.

POSITA would have had a reasonable expectation of success implementing this combination. EX1003, ¶209. Both Miller and Baldassarre disclose components commonly used in power systems—controllers, transfer switches, and chargeable batteries—and both operate within the same technical field of power management. EX1003, ¶209. Integrating Miller's control logic with Baldassarre's switch would have required only routine engineering to exchange control signals indicating the switch's position to enable or disable charging accordingly. EX1003, ¶209. The result would predictably yield a system that automatically stops charging when

disconnected from the grid when necessary to conserve backup power. EX1003, ¶209.

2. Claim Element Analysis

[16.] A power system as claimed in claim 5 further including a transfer switch which may output power from a power grid or from the power source to provide power to the one or more of a plurality of loads, the power system operating to charge the at least one rechargeable battery from the power grid via the transfer switch output when the transfer switch outputs grid power, with the power system stopping the charging of the at least one rechargeable battery via the output of the transfer switch when the transfer switch outputs power from the power source to provide power to the one or more of a plurality of loads.

Supra Lasseter-Lopes-Baldassarre [13] (transfer switch outputs grid or microsource power); *supra* Lasseter-Lopes-Miller [5]-[6] (rechargeable battery from grid). “During normal operation, power from one or more...power sources can be used to charge storage units **105** and **106** and/or to meet demand in addition to electric grid **115**.” EX1026, 4:4-7. “During power outages or brownouts from grid **115**...storage units **105** and **106**[] can...meet energy demand.” EX1026, 5:7-9. POSITA would have found obvious to not charge the batteries during a power outage when incorporating Baldassarre’s transfer switch—doing so conserves auxiliary-source power for load support rather than battery charging, which would have been a predictable and desirable design choice. EX1003, ¶210.

IV. CONCLUSION

The Challenged Claims are unpatentable.

V. FEES

Petitioner authorizes charge of fees to Deposit Account 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Generac Power Systems, Inc. is the real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '857 Patent is the subject of civil action *PSLC LLC v. Generac Power Systems, Inc.*, 2-24-cv-01270 filed October 7, 2024. Petitioner is not aware of any disclaimers, reexamination certificates, or IPR petitions addressing the '857 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR58936-0002IP1@fr.com

(referencing No. 58936-0002IP1 and cc'ing PTABInbound@fr.com).

Attorney Docket No. 58936-0002IP1

IPR of U.S. Patent No. 11,967,857

Respectfully submitted,

Dated October 10, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 13,924 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated October 10, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) et seq. and 42.105(b), the undersigned certifies that on October 10, 2025, a complete and entire copy of this Petition for Inter Partes Review and all supporting exhibits were provided by Federal Express, to the Patent Owner, by serving the correspondence address of record as follows:

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