IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Russell E. Shetler, Jr. and David Sonner
U.S. Patent No.:	9,000,613
Issue Date:	April 7, 2015
Serial No.:	13/465,273
Filing Date:	May 7, 2012
Title:	UPS Adaptive Output Voltage Control Systems

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REQUEST FOR *EX PARTE* REEXAMINATION OF
U.S. PATENT NO. 9,000,613 UNDER 35 U.S.C. § 302 AND 37 C.F.R. § 1.510

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*All emphasis added unless otherwise noted.

I.   INTRODUCTION

Schneider Electric SE and Schneider Electric USA, Inc. (collectively, "Schneider") hereby request under 35 U.S.C. § 302 and 37 C.F.R. § 1.510 reexamination of claims 1–11 and 16–20 (the "Challenged Claims") of U.S. Patent No. 9,000,613 (the "'613 patent") (Appendix A), assigned to Data PowerWorks, LLC ("DPW" or "Patent Owner").

This request presents substantial new questions of patentability as to each of the Challenged Claims, identifying prior art references that were not previously substantively considered during any examination of the '613 patent. As shown in detail below, the Challenged Claims of the '613 patent were anticipated and obvious as of the (alleged) priority date of June 3, 2011 (and much earlier) in view of the prior art discussed herein, and a skilled artisan would have been motivated to incorporate all claimed features together to render the claims of the '613 patent unpatentable. Because this request presents at least one substantial new question of patentability, *ex parte* reexamination should be granted and each of the challenged claims should be canceled as unpatentable.

II.   THE '613 PATENT

A.   Overview of the '613 Patent

The '613 patent is titled "UPS Adaptive Output Voltage Control Systems." Appendix A at Cover. The '613 patent was issued on April 7, 2015, to Russell E. Shetler, Jr. and David Sonner from U.S. Patent Appl. No. 13/465,273, filed on May 7, 2012, which claims priority to provisional application No. 61/492,953, filed on June 3, 2011. *Id.*

The '613 patent is directed to a method and system for controlling the output voltage of an uninterruptible power supply ("UPS") when switching between operative modes of a UPS. Appendix A at Abstract. The '613 patent also claims the use of a rectifier, an inverter, and a bypass switch to implement operative modes of a UPS, such as a "UPS mode" and a "bypass mode." *Id.*

In these modes, the state of the bypass switch—either engaged (bypass state) or disengaged (non-bypass state)—determines whether the rectifier-inverter circuit is bypassed, providing input power directly to the load. *Id*. As discussed in the detailed analysis below, however, none of this was novel and non-obvious as of the alleged priority date of the '613 patent. Indeed, prior-art references, such as U.S. Patent No. 7,372,177 ("Colombi"), disclose all key features of the '613 patent, including the use of adaptive voltage control mode after switching from the bypass mode to the UPS mode.

One embodiment of the '613 patent is shown in Figure 1, which depicts UPS system 10:

FIG. 1
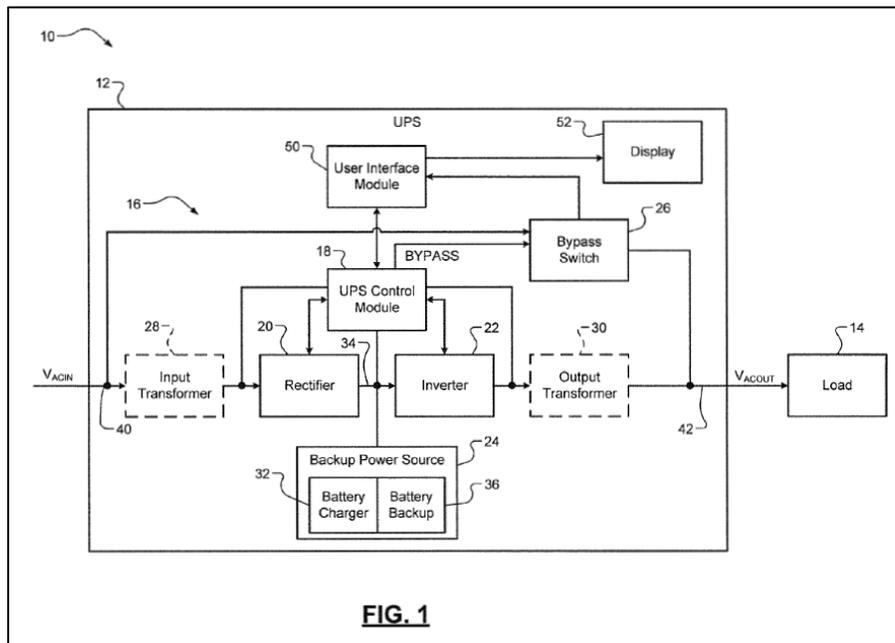
UPS system 10 includes one or more UPS, such as UPS 12, that supply AC power to one or more loads, such as load 14. The '613 patent explains that the loads may include one or more server power supplies, network switches and devices, telecommunication switches and devices, audio/video hubs and devices, air conditioning units, medical devices and equipment, and industrial devices and equipment. *Id*. at 4:36–40. The UPS 12 includes a double conversion UPS power circuit 16 and a UPS control module 18. *Id*. at 4:41–42. The UPS power circuit 16 includes

a rectifier 20 and an inverter 22. *Id.* at 4:42–43. UPS 12 includes a backup power source 24 and a bypass switch 26. *Id.* at 4:43–45. In operation, the UPS control module 18 monitors inputs and outputs of the devices in UPS 12, and controls operation of the double conversion UPS power circuit 16, backup power source 24 and bypass switch 26 based on the inputs and outputs. *Id.* at 4:51–55.

B. Prosecution History

The patent application that issued as the '613 patent was filed on May 7, 2012, and went through a rejection and amendment before a Notice of Allowance issued on January 22, 2015. On December 5, 2014, the Examiner rejected Claims 1–20 as directed to the same invention as that of claims 1–19 of commonly assigned co-pending Application No. 14/078,884 (U.S. Pub. No. 2014/0139022) which issued as U.S. Patent No. 9,531,288. Appendix B at 99–100. During an interview with the Examiner on December 12, 2014, and in the applicant's response to Office Action dated December 15, 2014, the Applicant asserted that the application recited different limitations than the claims of the co-pending application 14/078,884. *Id.* at 108–111. The Examiner subsequently withdrew the double patenting rejection and issued a notice of allowance. *Id.* at 115. The Examiner did not issue any rejections based on anticipation or obviousness.

C. Level of Ordinary Skill in the Art

A person of ordinary skill in the art ("POSA") of the '613 patent at the time of the alleged invention would have had a B.S. in electrical engineering or a related field, or the equivalent, and two or more years of industry or research experience in power electronics, and/or uninterruptible power systems. Appendix C at ¶¶ 33-36. Additional relevant education may compensate for less experience, and vice-versa. *Id*.

D. Claim Construction

The '613 patent is not expired. Accordingly, the broadest reasonable interpretation standard should be applied to this request. *In re Swanson*, 540 F.3d 1368, 1377–78 (Fed. Cir. 2008).

III. TECHNICAL REQUIREMENTS FOR *EX PARTE* REEXAMINATION UNDER 37 C.F.R. § 1.510

This reexamination request satisfies each requirement for *ex parte* reexamination of the '613 patent for the reasons set forth below.

A. 37 C.F.R. § l.510(b)(l): Statement Pointing Out Each Substantial New Question of Patentability

A statement pointing out each substantial new question of patentability ("SNQ") based on the cited patents and printed publications in accordance with 37 C.F.R. § 1.510 (b)(l) is provided below in Sections IV and V.

B. 37 C.F.R. § l.510(b)(2): Identification of Every Claim for which Reexamination is Requested

Reexamination is requested for claims 1–11 and 16–20 of the '613 patent in view of the prior art references discussed below.

C. 37 C.F.R. § l.510(b)(2): Detailed Explanation of the Pertinency and Manner of Applying the Prior Art

A detailed explanation of the pertinency and manner of applying the prior art to every claim for which reexamination is requested in accordance with 37 C.F.R. § 1.510(b)(2) is provided below in Section V.

D. 37 C.F.R. § l.510(b)(3): Copy of Every Patent or Printed Publication Relied upon or Referred to

Requestor provides a copy of every patent or printed publication relied upon or referred to in this *ex parte* reexamination request as Appendices A-H. For convenience, the cited patents and printed publications are listed on a Form PTO-1449, which is attached.

E. 37 C.F.R. § l.510(b)(4): Copy of the Entire Patent

Requestors have provided a full copy of the '613 patent as Appendix A in accordance with 37 C.F.R. § 1.510(b)(4).

F. 37 C.F.R. § l.510(b)(5): Certification of Service

In accordance with 37 C.F.R. § 1.510(b)(5), Requestors provide a certification that a copy of the request has been served in its entirety on the patent owner at the address as provided for in § 1.33(c). The name and address of the party served has been indicated.

G. 37 C.F.R. § l.510(b)(6): Certification by the Third-Party Requester

In accordance with 37 C.F.R. § 1.510(b)(6), Requestor certifies that the statutory estoppel provisions of 35 U.S.C. § 315(e)(1) or 35 U.S.C. § 325(e)(1) do not prohibit Requestor from filing this *ex parte* reexamination request.

H. 37 C.F.R. § l.510(a): Fee for Requesting Reexamination

The Patent and Trademark Office is authorized to charge Deposit Account No. 506092 for the fee set in 37 C.F.R. § l.510(a) for this Request and further authorizes payment for any additional fees to be charged to this Deposit Account.

I. Identification of Related Matters

Below is a list of prior and pending proceedings involving the '613 patent.

Case Name	Case Number	Jurisdiction	Filed
Data PowerWorks, LLC, v. Schneider Electric SE	2:25-cv-00300-JRG	E.D. Tex.	March 13, 2025

IV. THE PRIOR ART

The prior art discloses systems and methods for controlling output voltage in an uninterruptible power supply as claimed in the '613 patent, including that the UPS system include a "control module" that "operates in a normal UPS mode and an adaptive voltage control mode" wherein "the control module, when operating in the adaptive voltage control mode, adjusts the

second alternating current voltage from a first level to a second level upon switching from the bypass mode to the UPS mode." Indeed, Colombi discloses just such systems and methods. The prior art discussed herein, including Colombi and Shetler '124, when considered alone or in combination anticipates and renders obvious the Challenged Claims.

A. **The Prior Art Raises Substantial New Questions of Patentability**

Below is an overview of each of the prior art references that form the basis of the substantial new questions of patentability. As discussed below, the references disclose the claimed features of the '613 Patent in their entirety. In particular, the primary reference Colombi was not made of record during prosecution of the '613 patent, and Colombi discloses and teaches all the limitations that the Office previously believed were not sufficiently disclosed in the prior art of record.

These new grounds provide noncumulative technological teachings that were not previously considered and discussed on the record during prosecution of the '613 patent. The new teachings are such that there is substantial likelihood that a reasonable examiner would have considered them important in determining whether or not the Challenged Claims are patentable, which they are not.

1. **Colombi (Appendix D)**

U.S. Patent No. 7,372,177 to Colombi et al. is prior art under at least pre-AIA 35 U.S.C. § 102(b) because it was filed on September 15, 2005, and issued on May 13, 2008. Appendix D at Cover. Colombi is titled "Control System, Method And Product For Uninterruptible Power Supply." *Id.*

Just like the '613 patent, Colombi is directed to the system and method of operating and controlling an uninterruptible power supply: a "control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* 1:14–16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for

economic control thereof."). Colombi discloses a UPS with two selectable feed paths, including "a first feed path and a second feed path, where the first feed path is operable in parallel with the second feed path." Appendix D at Abstract. The "first feed path is engagable [sic] [by] a first switch to deliver a bypass current to the load[,]" while "[t]he second feed path includes a rectifier, an inverter responsive to a control signal and in electrical communication with the rectifier." *Id.* This generic UPS architecture is illustrated in Fig. 1.
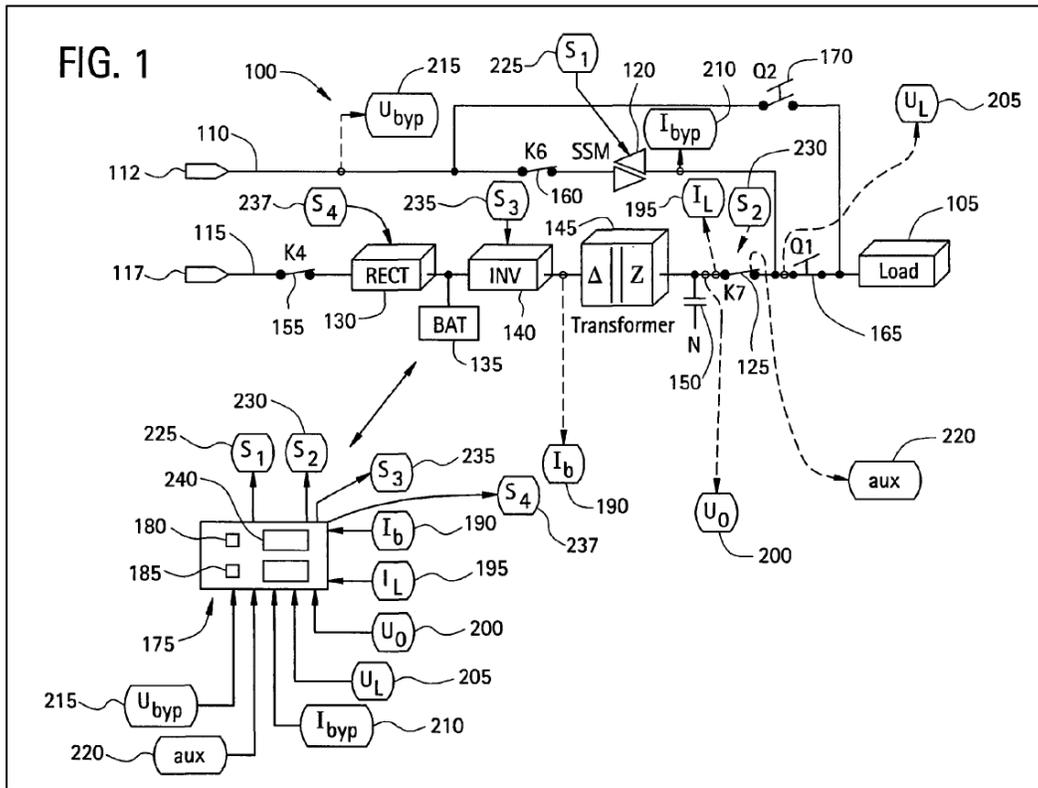
Appendix D at Fig. 1.

Colombi further discloses a control scheme that includes the use of an "ECOMODE." In ECOMODE, the load is fed by the power input ("mains") through the bypass feed path without engaging the UPS path that includes the rectifier and the inverter. Appendix D at 1:38–40, 4:48–52. As soon as a fault is detected, the load is switched to the inverter feed path. *Id.* at 1:40–41, 4:53–55. Further, Colombi discloses an "adaptive voltage control scheme" in which output

voltages "are continuously monitored via an adaptive voltage monitoring scheme," such as "by continuously adapting the rms voltage of each phase model voltage to the rms voltage of the corresponding utility phase voltage." *Id.* at 7:43-8:3. Under this "adaptive voltage control scheme," Colombi teaches that a "boost" to the inverter reference voltages can be applied. *Id.* at 8:4-30.

In sum, Colombi recites a UPS system with two feed paths, specific control schemes and systems for fault detection, switchover from the UPS mode to the bypass mode and vice versa, and adaptive voltage control during switchovers. None of these teachings were considered during the initial prosecution.

Accordingly, Colombi raises at least one SNQ.

2. Shetler '124 (Appendix E)

U.S. Patent No. 6,917,124 to Shetler et al. is prior art under at least pre-AIA 35 U.S.C. § 102(b) because it was filed on October 26, 2001, and published on March 13, 2003. Appendix E at Cover. The named inventor of Shetler '124 is also an inventor of the '613 patent. *Id.* Shetler '124 is titled "Uninterruptible Power Supply." *Id.* Shetler '124 was disclosed during the prosecution of the '613 patent but was not substantively discussed or examined. Appendix B at 104.

Shetler '124 discloses an uninterruptible power supply controlled by a digital, multi-microprocessor controller that coordinates the charger/rectifier, inverter, output LC filter, static bypass switch, and associated contactors. Appendix E at Abstract, 1:21-34. Just like the '613 patent, Shetler '124 discloses a control scheme for a UPS, including a control scheme and system for switching from a UPS mode to bypass mode (and vice versa).

Shetler '124 describes that during transfer to a bypass mode, "[t]he inverter voltage is matched to the bypass voltage phase and magnitude." *Id.* at 38:42–45. This adjustment occurs in a ramping, gradual, and "seamless" manner over a duration of time. *See id.* at 38:45-49 (explaining

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that the adjustment happens over "[*a*] *5-cycle delay*" and because of the delay, "the load has been transferred to the bypass *seamlessly*."). Shetler '124 also explains that "[t]he Rectifier DSP implements rectifier walk-in control … [which] limits the DC bus voltage rate of increase by *ramping* the DC bus setpoint from zero to the nominal DC bus setpoint over a 10 second period." *Id.* at 26:1-5.

Further, Shetler '124 discloses a fault detection module that detects faults by monitoring UPS parameters and determining the type of faults, including immediate faults and non-immediate faults. For example, Shetler '124 describes a control system with a rectifier digital signal processor ("DSP"), which detects faults including "timing or sanity errors, over temperature, overload, complete battery discharge, and component failures." Appendix E at 8:28–31.

Accordingly, Shetler '124 raises at least one SNQ.

V. SPECIFIC APPLICATION OF PRIOR ART TO CHALLENGED CLAIMS

A detailed application of the prior art references discussed above to each of claims is set forth below. The following table summarizes the substantial new grounds of patentability addressed in this Request:

SNQ #	Basis	Claims
1A	Anticipated under § 102 by Colombi	1–4, 16–17
1B	Obvious under § 103 in view of Colombi	3, 4, 10, and 17
1C	Obvious under § 103 in view of Colombi and Shetler '124	3–11, 17–20

In addition to the prior art references themselves, the substantial new grounds of patentability are supported by Appendix C, a Declaration of Dr. R. Jacob Baker, and numerous supporting pieces of evidence contained in Appendices A-H.

The prior art references discussed above make up multiple new grounds for non-patentability. These grounds present new technological teachings not found in the prosecution history with new prior art combinations and arguments not previously considered that address all

elements of the Challenged Claims, including an "uninterruptible power supply" including a "control module" that "when in the UPS mode, further operates in a normal UPS mode and an adaptive voltage control mode" and that "when operating in the adaptive voltage control mode, adjusts the second alternating current voltage from a first level to a second level upon switching from the bypass mode to the UPS mode."

Colombi anticipates or renders obvious each of the Challenged Claims. Alternatively, Colombi in further combination with Shetler '124 further renders the Challenged Claims obvious.[1]

A. Ground 1A (SNQ #1): Claims 1–4, 16, and 17 Are Anticipated by Colombi

1. Independent Claim 1

a. Element [1.pre]: "An uninterruptible power supply comprising:"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply. For example, Colombi describes a "control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14–16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."), 2:61-3:15 (describing UPS structure), Fig. 1.

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[1] Requesters do not concede that any Challenged Claims satisfy other requirements for patentability that cannot be raised in EPR, including Section 101 and 112.

FIG. 1

b.   Element [1.1]: "a rectifier coupled to an input of the uninterruptible power supply and converting a first alternating current having a first alternating current voltage to a direct current provided to a direct current bus;"

Colombi describes a UPS which "includes a first feed path and a second feed path, where the first feed path is operable in parallel with the second feed path. The first feed path is engagable via a first switch to deliver a bypass current to the load. The second feed path includes a rectifier, an inverter responsive to a control signal and in electrical communication with the rectifier, and an output transformer in electrical communication with the inverter." Appendix D at 1:53-60; *see also id.* at 3:19-23 (describing power source 117 for the inverter feed path 115), 3:32-34 (describing that inverter feed path 115, which is coupled with power source 117, includes a rectifier 130). As shown below in Figure 1, the rectifier is coupled to an input (power source 117) of the UPS:

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Appendix D at Fig. 1 (annotations added).

Furthermore, Colombi discloses that the rectifier converts a first alternating current having a first alternating current voltage to a direct current. For example, Colombi describes that "[d]uring normal (inverter feed path 115) operation, the rectifier 130 converts the input power supply 117 to regulated DC to charge battery 135 as well as supply power to the inverter 140." *Id.* at 4:27-30. As further shown in Figure 1, the rectifier output this direct current to a direct current bus that is connected to the battery and inverter.

FIG. 1

Appendix D at Fig. 1 (annotations added).

Thus, Colombi discloses this limitation.

>   c.   **Element [1.2]: "an inverter coupled to an output of the uninterruptible power supply and converting direct current provided by the direct current bus to an [sic] second alternating current having a second alternating current voltage;"**

Colombi describes an inverter that converts direct current provided by the direct current bus to a second alternating current with a second alternating current voltage. For example, Colombi describes that "[t]he inverter 140 converts the DC" received through the direct current bus from the rectifier 130 "to a voltage & frequency regulated AC output at all times." *Id.* at 4:30-31, Fig. 1. Further, Colombi's inverter is coupled to the output of the UPS. As shown in Figure 1, the inverter is connected to a transformer and other components that lead to a load 105.

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FIG. 1

Appendix D at Fig. 1 (annotations added); Appendix C at ¶ 38.

To the extent that the claim language is interpreted to require labeling the inverter output voltage as a "second alternating current voltage" relative to a "first alternating current voltage," a POSA would have understood from the disclosure that the inverter converts DC from the rectifier or battery into an AC output that is delivered to the load, distinct from the AC voltage provided by the bypass path. The presence of an output isolation transformer and the description of a "voltage & frequency regulated AC output" make clear to a POSA that the inverter output constitutes a second AC voltage, functionally separate from the input or bypass AC voltage. Further, as shown below in Figure 1 of Colombi, the inverter is coupled to the output of the UPS, via a downstream transformer. Appendix C. at ¶ 39.
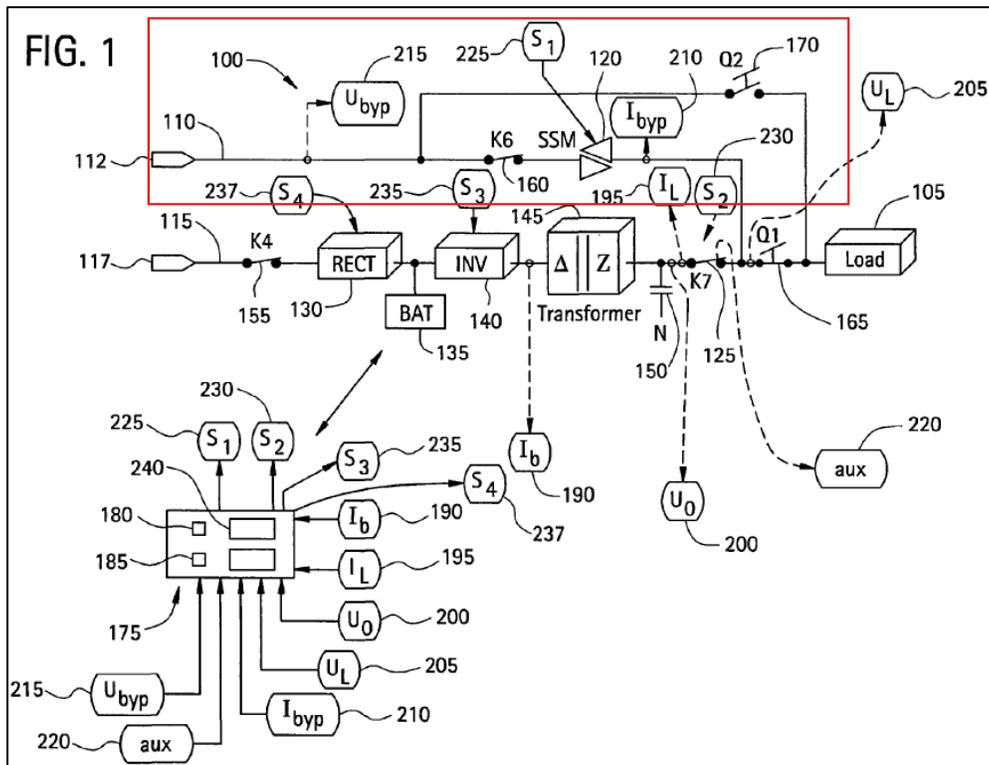
FIG. 1

Appendix D. at Fig. 1 (annotations added).

Thus, Colombi discloses this limitation.

> **d.   Element [1.3]: "a bypass switch having a bypass state and a non-bypass state, wherein the bypass switch is configured to bypass the rectifier and the inverter and provide a bypass voltage from the input to the output when in the bypass state;"**

Colombi discloses a bypass switch that is configured to bypass the rectifier and the inverter and provide a bypass voltage from the UPS input to the output when in a bypass state. For example, Colombi describes a UPS with two feed paths, wherein "[t]he first feed path is engagable via a first switch to deliver a bypass current to the load." Appendix D at 1:53-56. The "bypass feed path 110 is engageable with the load 105 via a first switch 120 to deliver a bypass current to the load 105." *Id.* at 3:24-28. This claim element is illustrated below in Figure 1, in which bypass feed path

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110 is connected from power source 112 (Appendix D at 3:19-21) and to the load 105, and which

bypasses feed path 115 along which the inverter and rectifier are located:
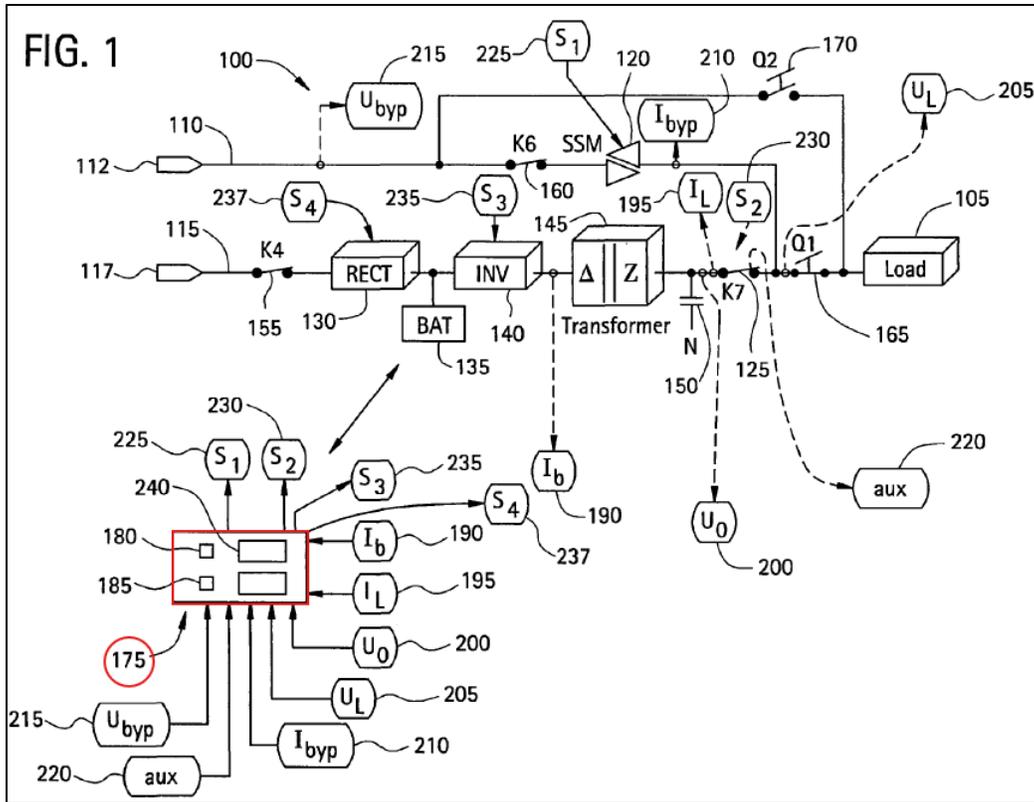

Appendix D at Fig. 1 (annotations added).

Colombi also teaches a bypass switch having a bypass state and a non-bypass state. For

example, Colombi discloses that "the first switch 120 is a remote controllable static switch module

(SSM) of a type known to one skilled in the art." Appendix D at 3:28-32. Using the switch,

"[b]ypass operation that switches in the bypass feed path 110 is possible through the first switch

120, which may be a Static Switch Module (SSM) for example." *Id.* at 4:35-38. Colombi further

explains that when the switch is "on," the system operates in a bypass state, and when the switch

is "off," the system operates in a non-bypass state. *See id.* at 5:10-12.

Thus, Colombi discloses this limitation.

e. **Element [1.4]: "a control module that operates in a bypass mode and a UPS mode, wherein the control module switches the bypass switch to the bypass state when in the bypass mode and switches the bypass switch to the non-bypass state when in the UPS mode,"**

Colombi discloses a control module that operates in a bypass mode and a UPS mode. For example, Colombi explains that "[a]n embodiment of the invention includes a control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at 1:51-53. Colombi describes "control electronics" including "control system 175 includes a processing circuit 180 and a storage medium 185, readable by the processing circuit 180, storing instructions for execution by the processing circuit for controlling the UPS 100 in a manner to be described in more detail below." *Id.* at 3:48-52. The control system 175 receives a variety of "input signals" and provides "output signals" that include a "command signal (S1) 225 to first switch 120," which is the switch discussed above in the bypass feed path 110. *Id.* at 4:1-5. Colombi discloses that "transitions from the bypass feed path 110 to the inverter feed path 115 and vice-versa are controlled through the SSM 120 and breaker switch (K7) 125." *Id.* at 4:46-48, 4:35-38 ("Bypass operation that switches in the bypass feed path 110 is possible through the first switch 120…"). Thus, the control module is responsible for switching the bypass switch to the bypass state when in the bypass mode and switching the bypass switch to the non-bypass state when in the UPS mode.

The control module is illustrated in Figure 1:

FIG. 1

Appendix D at Fig. 1 (annotations added); *see also id.* at Fig. 2 (labeling control system 175 as responsible for "Detection & Control").

Thus, Colombi discloses this limitation.

> f.   **Element [1.5]: "wherein the control module, when in the UPS mode, further operates in a normal UPS mode and an adaptive voltage control mode, and"**

Colombi describes "a control system 175" including "a processing circuit 180 and a storage medium 185, readable by the processing circuit 180, storing instructions for execution by the processing circuit for controlling the UPS 100 in a manner to be described in more detail below." Appendix D at 3:48-52.

Colombi discloses that the control module operates in both a "normal UPS mode" and an "adaptive voltage control mode." For example, Colombi describes "normal" operation of the inverter feed path 115, through which power passes through the rectifier 130 and inverter 140 and

also charges the battery. *Id.* at 4:27-30; *see also id.* at 1:38-41 ("As soon as a problem on the mains is detected, the load is switched on to the inverter.").

Colombi also discloses an adaptive voltage control mode that "provides an accurate and robust detection" of utility disturbances. Appendix D at 7:43-51. Colombi teaches that the "adaptive voltage monitoring scheme" is "embedded within the software of control system 175." *Id.* at 7:46-51. Colombi's adaptive voltage monitoring scheme provides for "a voltage boost factor k_B" that "is used to introduce a transient boost on the inverter reference voltages Ui_ref for an output voltage controller 420," which is "part of control circuitry 240 of control system 175." *Id.* at 8:17-25.

Thus, Colombi discloses this limitation.

> g. **Element [1.6]: "wherein the control module, when operating in the adaptive voltage control mode, adjusts the second alternating current voltage from a first level to a second level upon switching from the bypass mode to the UPS mode."**

Colombi describes a control module that, when operating in the adaptive voltage control mode, adjusts the second alternating current voltage from a first level to a second level upon switching from the bypass mode to the UPS mode. For example, Colombi's "adaptive voltage monitoring scheme" provides a "transient boost" that results in an increase in the inverter output voltage "[when] switching from bypass feed path 110 to the inverter feed path 115." Appendix D at 8:4-23. Appendix C at ¶ 40.

Colombi discloses that in the adaptive monitoring scheme, the control system 175 sends the "SSM command signal S1 to 0" which initiates switching from the bypass path to the inverter path. *See id.* at 8:4-8; *see also id.* 4:35-38, 7:36-42 (describing that command signal S1 is "used in and by control system 175"), Fig. 5 (showing "exemplary flow chart 300" that illustrates control sequence of "adaptive voltage monitoring scheme embedded within the software of control system

175). As illustrated in Figure 7, Colombi discloses that a "boost factor" of K_B is then applied to the inverter voltage (U_{i_ref}) such that upon switching from the bypass mode to the UPS mode, the inverter voltage is boosted from a first level to a second level. *Id.* at 8:17-19. Appendix C at ¶ 41.

As Figure 7 illustrates, the reference voltage is multiplied by the transfer function G(s) which "represents the transient effect of the boost action." *Id.* at 8:23-25. Then, the modified U_{i_ref} passes through the voltage controller 420 to output U_{inv}, and the application of transfer function G(s) to the inverter voltage results in an increase from a first level to a second level. *Id.* Appendix C at ¶ 42. As shown in the annotations below, Figure 7 includes a graphical representation showing that the second alternating current voltage is at a "first level" (left side of Y-axis) and increases to a "second level" before gradually returning the second alternating current voltage level to a lower level over time.
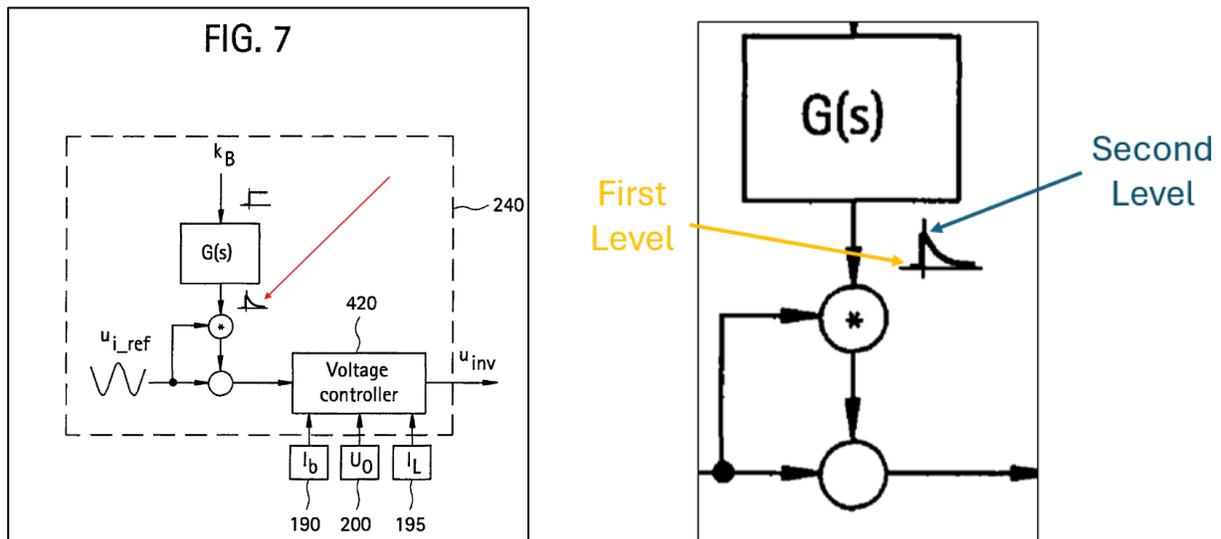
Appendix D at Fig. 7 (annotations added). Accordingly, "[t]his boost, together with the bandwidth of the output voltage controller 420, allows a prompt reaction of the inverter 140 via inverter control voltage U_{inv}" which "helps to minimize the distortion of the output voltage." *Id.* at 8:13-28; Appendix C at ¶ 42.

Thus, Colombi discloses this limitation.

2. Dependent Claim 2

a. Element [2.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control."); *see supra* Section V.A.1.

b. Element [2.1]: "wherein the control module maintains the second alternating current voltage at the first level when in at least one of the bypass mode and the normal UPS mode."

Colombi discloses that the control module maintains the second alternating current voltage at the first level when in at least one of the bypass mode and the normal UPS mode. For example, Colombi discloses a UPS that includes "a bypass feed path 110 and an inverter feed path 115 that are operable in parallel with each other during the transfer of power from one path to the other." Appendix D at 3:17-21. When operating in normal UPS mode, "the rectifier 130 converts the input power supply 117 to regulated DC to charge the battery 135 as well as supply power to the inverter 140" and the "inverter 140 converts the DC to a voltage & frequency regulated AC output at all times." *Id.* at 4:27-31; *see also id.* at 5:7-20 (inverter operates under "no-load" conditions). In other words, Colombi teaches that the second alternating current voltage (i.e., inverter output voltage) is maintained at a first level to supply power to the load 105 and power the battery. Appendix C at ¶ 43.

Thus, Colombi discloses this limitation.
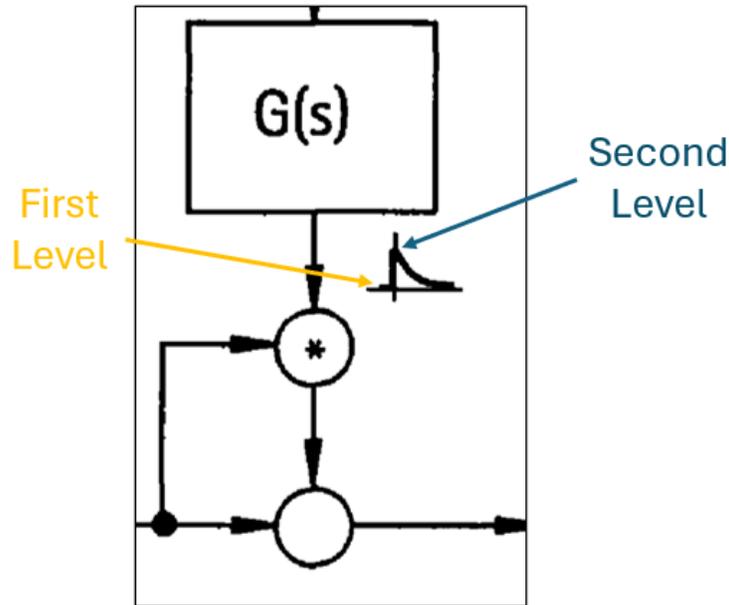
3. Dependent Claim 3

a. Element [3.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14–16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [3.1]: "wherein the control module ramps the second alternating current voltage from the first level to the second level while operating in the adaptive voltage control mode."

Colombi discloses that the control module ramps the second alternating current voltage from the first level to the second level when operating in the adaptive voltage control mode. The '613 patent provides that "[w]hen the UPS 12 is in the adaptive voltage control mode, the UPS control module 18 may increase (or ramp up) the AC output voltage V_{ACOUT} from a static bypass voltage to a set adaptive voltage and/or decrease (or ramp down) the AC output voltage V_{ACOUT} from the set adaptive voltage to the static bypass voltage." Appendix A at 6:40-45. Under the broadest reasonable interpretation of "ramps," Colombi teaches this limitation. As discussed above for Element 1.6, Colombi teaches that "[j]ust before switching on the inverter 140 (step 330), a voltage boost factor k_B is set to a specific value B (process step 325)." Appendix D at 8:17–19. This action is not a mere instantaneous step change, but rather initiates a controlled increase in the inverter output voltage. Appendix C at ¶ 44.

As Figure 7 illustrates, Colombi's control module (control system 175) instructs the system to increase the second alternating current voltage from the first level to the second level over a period of time. Appendix C at ¶ 45.

Appendix D at Fig. 7 (annotations added).

Thus, Colombi discloses this limitation.

4. Dependent Claim 4

#### a. Element [4.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply

as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible

power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The

present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to

control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [4.1]: "further comprising a fault detection module that monitors at least one parameter of a device of the uninterruptible power supply and generates a fault signal based on the at least one parameter, wherein the control module adjusts the second alternating current voltage from the second level to the first level based on the fault signal."

Colombi describes a fault detection module that monitors at least one parameter of a device

of the UPS and generates a fault signal based on that parameter. The '613 patent provides that the

"fault detection module 112 may detect, receive and/or monitor at least one parameter of a device of the UPS 12, such as the voltages V_{ACIN}…." Appendix A at 7:42-47. Colombi discloses the same. For example, Colombi discloses that "the load 105 is fed by the bypass feed path 110 (also referred to as the mains) while the control system 175 constantly monitors the quality of power in that path." Appendix D at 4:49-53. Colombi further describes that "[a]s soon as a problem in the bypass feed path 110 is detected, control system 175 switches the load 105 to the inverter feed path 115." *Id.* at 4:53-55. Colombi repeatedly discloses how the control system 175 detects "a fault … on the bypass feed path 110" and switches the system to the inverter path in response. Appendix D at 5:10-15, 5:40-43, 6:22-24, 7:6-11, 7:23-27. *See also* Appendix C at ¶ 46.

Colombi further discloses that the control module adjusts the second alternating current voltage from the second level to the first level based on the fault signal. As discussed above for Elements 1.5 and 1.6, Colombi teaches an "adaptive voltage monitoring scheme embedded within the software of control system 175" that "provides for accurate and robust detection of the utility disturbances." Appendix D at 7:43-51. Colombi teaches that "if the output voltage monitoring is not OK for every phase)," *i.e.*, a fault is detected, "the process of switching from bypass feed path 110 to the inverter feed path 115 is initiated." *Id.* at 8:4-8. This causes Colombi's system (operating in the "adaptive voltage monitoring scheme") to apply the "transient boost on the inverter reference voltages," as discussed above. *Id.* at 8:17-23. After the fault signal causes Colombi's system to apply the transient boost, the UPS adjusts the second alternating current voltage from the second level to the first level based on the fault signal, as illustrated in Figure 7 below.
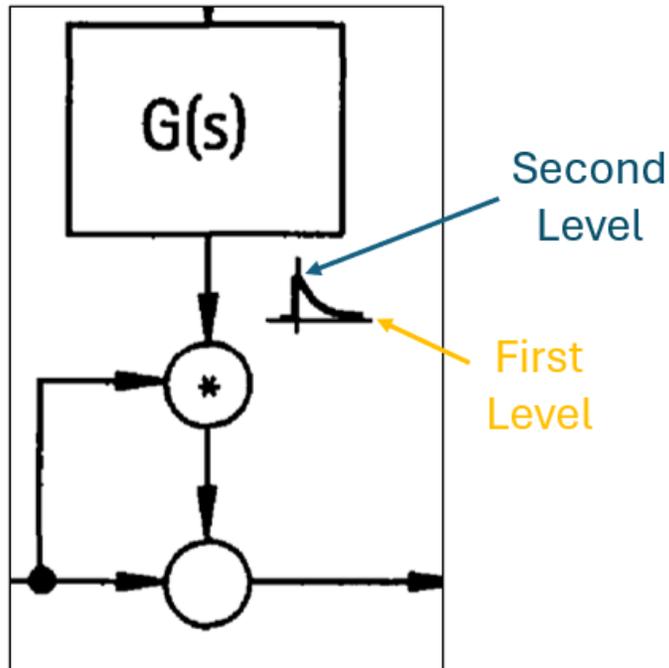
Appendix D at Fig. 7 (annotations added). Appendix C at ¶ 47.

Thus, Colombi discloses this limitation.

5.   Independent Claim 16

Other than the distinction that claim 1 is directed to an uninterruptible power supply and claim 16 is directed to a method of operating an uninterruptible power supply, there are no substantive differences in the technical content or limitations recited in the two claims. *See supra* Section V.A.1.a-g; Appendix C at ¶ 48.

6.   Dependent Claim 17

Other than the distinction that claim 4 is directed to an uninterruptible power supply with a fault detection module and claim 17 is directed to a method of detecting a type of fault in the uninterruptible power supply, there are no substantive differences in the technical content or limitations recited in claims 4 and 17. *See supra* Section V.A.4; Appendix C at ¶ 49.

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B.   Ground 1B (SNQ #2): Claims 3, 4, 10, and 17 Are Obvious in View of Colombi

    1.   Dependent Claim 3

        a.   Element [3.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

        b.   Element [3.1]: "wherein the control module ramps the second alternating current voltage from the first level to the second level while operating in the adaptive voltage control mode."

To the extent that the Office concludes that Colombi's voltage boost factor k_B does not result in the second alternating current "ramp[ing]" from the first level to the second level, that subject matter would have been obvious. A POSA would have been motivated to "ramp" the second alternating current voltage from a first level to a second level during the transition from bypass mode to UPS mode in order to ensure a smooth and controlled transfer of power to the load, minimize voltage transients, and prevent undesirable effects such as transformer de-magnetization, inrush currents, or output voltage distortion. Appendix C at ¶ 51.

Colombi specifically teaches that, upon switching from bypass to inverter operation, the control system implements a soft start of the inverter and applies a transient voltage boost to the inverter reference voltage, with the output voltage controller managing the voltage increase in a controlled manner. *See, e.g.*, the use of a voltage boost factor and time delay in Figs. 5 and 7. This approach allows the inverter output voltage to be gradually adjusted, thereby protecting sensitive loads and system components, and maintaining power quality—motivations that would

have been well understood and appreciated by a POSA seeking to optimize UPS performance and reliability during mode transitions. Appendix C at ¶ 52.

2. Dependent Claim 4

a. Element [4.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [4.1]: "further comprising a fault detection module that monitors at least one parameter of a device of the uninterruptible power supply and generates a fault signal based on the at least one parameter, wherein the control module adjusts the second alternating current voltage from the second level to the first level based on the fault signal."

Colombi describes a fault detection module that monitors at least one parameter of a device of the UPS and generates a fault signal based on that parameter. The '613 patent provides that the "fault detection module 112 may detect, receive and/or monitor at least one parameter of a device of the UPS 12, such as the voltages V_{ACIN}...." Appendix A at 7:42-52. Colombi discloses the same. For example, Colombi discloses that "the load 105 is fed by the bypass feed path 110 (also referred to as the mains) while the control system 175 constantly monitors the quality of power in that path." Appendix D at 4:49-53. Colombi further describes that "[a]s soon as a problem in the bypass feed path 110 is detected, control system 175 switches the load 105 to the inverter feed path 115." *Id.* at 4:53-55. Colombi repeatedly discloses how the control system 175 detects "a fault … on the bypass feed path 110" and switches the system to the inverter path in response. Appendix D at 5:10-15, 5:40-43, 6:21-24, 7:6-11, 7:23-27. Appendix C at ¶ 53.

Colombi further discloses that the control module adjusts the second alternating current voltage from the second level to the first level based on the fault signal. As discussed above for Elements 1.5 and 1.6, Colombi teaches an "adaptive voltage monitoring scheme embedded within the software of control system 175" that "provides for accurate and robust detection of the utility disturbances." Appendix D at 7:43-51. Colombi teaches that "if the output voltage monitoring is not OK for every phase)," *i.e.*, a fault is detected, "the process of switching from bypass feed path 110 to the inverter feed path 115 is initiated." *Id.* at 8:4-7. This causes Colombi's system (operating in the "adaptive voltage monitoring scheme") to apply the "transient boost on the inverter reference voltages," as discussed above. *Id.* at 8:17-23. After the fault signal causes Colombi's system to apply the transient boost, the UPS adjusts the second alternating current voltage from the second level to the first level based on the fault signal, as illustrated in Figure 7 below:
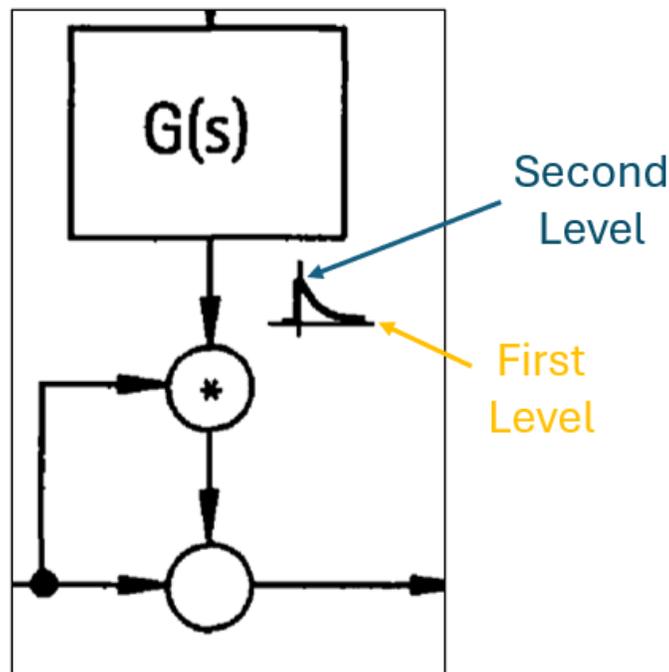
Appendix D at Fig. 7 (annotations added); *see also* Appendix C at ¶ 54.

To the extent that the claim language requires express teaching of adjusting the second alternating current voltage from the second level to the first level based on a fault signal, it would

have been obvious to do so in order to ensure a rapid and stable transition of power to the load during a fault, thereby minimizing voltage disturbances and maintaining power quality. Colombi explains that "[t]he basic idea of the time delay τI is to minimize the time … that the bypass feed path 110 and the inverter feed path 115 are paralleled, while avoiding a de-magnetization of the transformer 145, which helps to minimize the distortion of the output voltage Uo 200." Appendix D at 8:13-17. Colombi further explains that, just before switching on the inverter, "a voltage boost factor k_B is set to a specific value B ... to introduce a transient boost on the inverter reference voltages Ui_ref for an output voltage controller 420." *Id.* at 8:17-23. According to Colombi, this approach ensures that "the voltage at the load 105 [is] affected by the fault just during a short time duration (about 1.5 ms)" and that "the load voltage was restored within an acceptable standard tolerance." *Id.* at 7:11-30. Thus, it would have been obvious in Colombi to implement the claimed adjustment to achieve fast recovery and stable voltage at the load based on a fault signal. Appendix C at ¶ 55.

A POSA would have reasonably expected success implementing a voltage adjustment from a second level to a first level in response to a fault signal because Colombi describes a control system that actively monitors for faults and employs coordinated switching and voltage control strategies, including transient voltage boosting, to ensure rapid voltage recovery and stable output at the load, as demonstrated by empirical results showing minimal disturbance and quick restoration of voltage within standard tolerances. Appendix D at 6:57-7:35. The detailed control logic and proven system response would have provided a POSA confidence in achieving the desired fast and stable voltage adjustment based on a fault signal. Appendix C at ¶ 56.

3. Dependent Claim 10

a. Element [10.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [10.1]: "further comprising an interface module that: generates a control signal indicating operation in a selected one of an automatic mode or a manual mode; and generates an enable signal indicating whether the adaptive voltage control mode is enabled, wherein the control module switches between operating in the bypass mode and the adaptive voltage control mode and switches the bypass switch between the bypass state and the non-bypass state based on the control signal and the enable signal."

Colombi discloses a control system 175. It would have been obvious to modify Colombi to include an interface module with the claimed functionality because Colombi explicitly contemplates the use of both automatic and manual control modes, as well as the need for flexible, software-based control strategies. Colombi explains "a UPS control system and strategy that is adaptable to installed UPS systems by the implementation of control software only; a control system for UPSs that may be applied to various UPS topologies." Appendix D at 9:4-25. This demonstrates that Colombi's system is designed to be highly configurable and adaptable, making it straightforward for a POSA to implement an interface module configured to generate control signals for automatic or manual operation, as well as enable signals for specific control modes. Appendix C at ¶ 57.

Furthermore, Colombi's control system "constantly monitors the quality of power in [the bypass] path. As soon as a problem in the bypass feed path... is detected, control system 175 switches the load... to the inverter feed path." *Id.* at 4:49-55. The system's ability to switch between modes based on monitored conditions directly supports the POSA's motivation to add an interface module that generates an enable signal for an adaptive voltage control mode. Colombi also details that "[t]he transitions from the bypass feed path... to the inverter feed path [] and vice-versa are controlled through the SSM 120 and breaker switch (K7) 125," (*Id.* at 4:46-48) indicating that the control module already manages switching based on control signals. Therefore, a POSA would have recognized the benefit and feasibility of adding an interface module to generate the control and enable signals, allowing the control module to switch between bypass and adaptive voltage control modes, and to operate the bypass switch accordingly. Appendix C at ¶¶ 58-59.

4. Independent Claim 16

Other than the distinction that claim 1 is directed to an uninterruptible power supply and claim 16 is directed to a method of operating an uninterruptible power supply, there are no substantive differences in the technical content or limitations recited in the two claims. *See supra* Section V.A.1.a-g.; Appendix C at ¶ 60.

5. Dependent Claim 17

Other than the distinction that claim 4 is directed to an uninterruptible power supply with a fault detection module and claim 17 is directed to a method of detecting a type of fault in the uninterruptible power supply, there are no substantive differences in the technical content or limitations recited in claims 4 and 17. *See supra* Section V.A.4; Appendix C at ¶ 61.

C. Ground 1C (SNQ #3): Claims 3–11 and 17–20 Are Obvious in View of Colombi and Shetler '124

For the reasons set forth above in Grounds 1A and 1B, Colombi anticipates and/or renders obvious all limitations of claims 1–4, 10, and 16–17. To the extent the Office disagrees that Colombi discloses or teaches the subject matter recited by dependent claims 3-11 and 17-20, Colombi in view of Shetler '124 renders those claims obvious. Requesters incorporate by reference the analysis discussed above regarding independent claims 1 and 16 and do not repeat it below. *See supra* Parts V.B.1, V.B.6.

A POSA would have been motivated to combine the teachings of Shetler '124 and Colombi in order to achieve a more robust UPS system and method of controlling such a system. As discussed above, Colombi provides extensive disclosure regarding a UPS system and method that includes fault detection capabilities and other features intended to ensure accurate and robust detection of utility disturbances. Shetler '124 provides analogous disclosures, including additional implementation details regarding the components of these systems and switching between modes of operation. As such, a POSA would have considered these references together. Appendix C at ¶ 63.

Furthermore, a POSA would have had a reasonable expectation of success in modifying Colombi's UPS system and method with the teachings of Shetler '124. For example, both references teach UPS systems and methods with common elements, such as a rectifier, battery, inverter, and control elements that output to a load. Thus, implementing Shetler '124's teachings would have been well within the capabilities of a POSA, and would have involved nothing more than the combination of prior art elements according to known methods to yield predictable results, since the use of these techniques was well known and understood in the art as of June 2011. As such (and to the extent not taught by Colombi alone), this would require only routine modifications

to the software and hardware elements of Colombi's UPS system, e.g., control module, to implement features such as ramping of voltage levels, specific fault detection parameters, or switching of the bypass switch from a non-bypass mode to a bypass mode. Appendix C at ¶ 64.

1. Dependent Claim 3

a. Element [3.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [3.1]: "wherein the control module ramps the second alternating current voltage from the first level to the second level while operating in the adaptive voltage control mode."

Colombi describes a control module that, when operating in adaptive voltage control mode, adjusts the alternating current voltage from a first level to a second level. *See supra* Section V.B.3.b.

Shetler '124 teaches the well-known concept of "ramping." For example, Shetler '124 teaches a DPS that "limits the DC bus voltage rate of increase by ramping the DC bus setpoint from zero to the nominal DC bus setpoint over a 10 second period." Appendix E at 26:1-11; *see also id.* at Fig. 17A ("Ramp (10 seconds)"). In other words, a POSA would have understood Shetler '124 to teach increasing a voltage level over time, i.e., "ramping" the voltage. As described above, Shetler '124 further teaches "ramping" voltage from a "first level" (zero) to a "second level" (nominal DC bus setpoint). Appendix C at ¶ 66.

A POSA would have been motivated to incorporate these teachings of Shetler '124 into Colombi's UPS system and method (to the extent not disclosed by Colombi) to prevent transient

inrush currents and voltage overshoots that can occur when switching power sources or energizing components such as transformers and inverters. By gradually increasing the voltage setpoint, the system ensures a smooth transition that minimizes electrical and mechanical stress on components and enhances overall system stability and reliability. This controlled ramping is particularly important in adaptive voltage control modes, where precise regulation and disturbance rejection are critical for maintaining high power quality and protecting sensitive loads, as abrupt changes could otherwise lead to undesirable transients, increased harmonic distortion, or even component failure. Implementing such functionality would have been well within the capabilities of a POSA for the reasons discussed above. Appendix C at ¶ 67.

Implementing such functionality would have been well within the capabilities of a POSA. Given that Shetler '124 provides detailed implementation strategies for controlling inrush currents and voltage overshoots—issues that Colombi also recognizes and seeks to address—a POSA would have recognized that integrating these features would not require undue experimentation or inventive skill. Appendix C at ¶ 68.

2. Dependent Claim 4

a. Element [4.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b.   Element [4.1]: "further comprising a fault detection module that monitors at least one parameter of a device of the uninterruptible power supply and generates a fault signal based on the at least one parameter,"

Colombi discloses a fault detection module that monitors the system's input voltage and generates a fault signal if the quality of power in the bypass feed path deviates from predetermined ranges. *See supra* Section V.A.4.b, V.B.4.b.

Shetler '124 also discloses a fault detection module that monitors at least one parameter of a device of the uninterruptible power supply and generates a fault signal based on the at least one parameter. For example, Shetler '124 discloses a control module (control system 7) that includes "three digital signal processors ('DSPs') that perform all control computations for the UPS." Appendix E at 7:55-57. The "Comms DSP," one of the three DSPs in the control module, "controls high level system functions, including monitoring, and communications." *Id.* at 7:66-67. The Comms DSP monitors device parameters so that the "UPS system can automatically turn on the bypass switch if any abnormal conditions are detected that may jeopardize the quality of the power supplied to the load." *Id.* at 7:22-26. Shetler '124 describes that device parameters monitored by the Comms DSP include: "contactor position sensing, fan operational sensing, fuse status sensing, over temperature sensing, metering data (voltage, current, etc.), control data, and UPS operational status." *Id.* at 8:8-13. *See also* Appendix C at ¶ 70.

Shetler '124 further discloses that based on the detected parameters, the fault detection module generates fault signals. For example, Shetler '124 discloses that the Comms DSP within the control system "also performs all metering functions and controls status and alarm signals." *Id.* at 8:1-2. Shetler '124 further describes that the Comms DSP "handles the exchange of status, configuration and diagnostic information externally and internally to the control board," which includes information regarding "contactor position sensing, fan operational sensing, fuse status

sensing, over temperature sensing, metering data (voltage, current, etc.), control data, and UPS operational status." *Id.* at 8:4-13. Likewise, Shetler '124 provides that "[c]ontrol information" is communicated such as "system commends (on, off, transfer, retransfer, etc.), contractor actuation signals, breaker actuation signals, and fan control." *Id.* at 8:13-15; Appendix C at ¶ 71.

As another example of fault detection, Shetler '124 describes an "inverter DSP" within the control system explained above, which "monitors system measurements, both digital and analog, and makes decisions as to whether or not the inverter can safely support the load or is supporting the load adequately." Appendix E at 37:5-10. If "a failure is indicated" by the inverter DSP, the UPS startup sequence is terminated. *Id.* at 15:6-8. "An emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30; Appendix C at ¶ 72.

      c.   **Element [4.2]: "wherein the control module adjusts the second alternating current voltage from the second level to the first level based on the fault signal."**

Colombi discloses a control module that adjusts a second alternating current voltage from the second level to the first level based on the fault signal. *See supra* Section V.A.4.c, V.B.4.c.

Shetler '124 also discloses a control module that adjusts the second alternating current voltage from the second level to the first level based on the fault signal. Based on fault signal generated by the control system 7 as discussed above, Shetler '124's system automatically enables the UPS bypass path "if any abnormal conditions are detected that may jeopardize the quality of the power supplied to the load." Appendix E at 7:22-26. Shetler '124 teaches that during this transfer to the bypass mode, the control module adjusts the alternating current voltage from the "second level" (normal inverter output voltage) to the "first level" (bypass voltage from the input power). For example, Shetler '124 discloses that "[t]he inverter voltage is matched to the bypass voltage phase and magnitude" momentarily before the bypass is turned on so that the load can be "transferred to the bypass seamlessly." *Id.* at 38:42-49. *See also* Appendix C at ¶ 74.

A POSA would have understood that Colombi's transient transfer function G(s)—which governs the magnitude boost of the inverter voltage as shown in the lower graph plot of Figure 7—to be naturally triggered by the same fault conditions that initiate inverter-to-bypass transfer in Shetler '124. Shetler '124 teaches that detection of a fault condition necessitating bypass operation causes the control module to actively adjust the inverter output voltage so that the magnitude of the inverter output voltage matches that of the bypass source prior to the bypass transfer. *See* Appendix E at 38:42–45. Thus, in Shetler '124, a fault signal directly governs both the timing and manner of inverter voltage adjustment. Colombi likewise discloses that voltage adjustment during switching events is governed by the selectable transfer function G(s), which defines a smooth transient response applied to the inverter reference voltage U_{i_ref}:
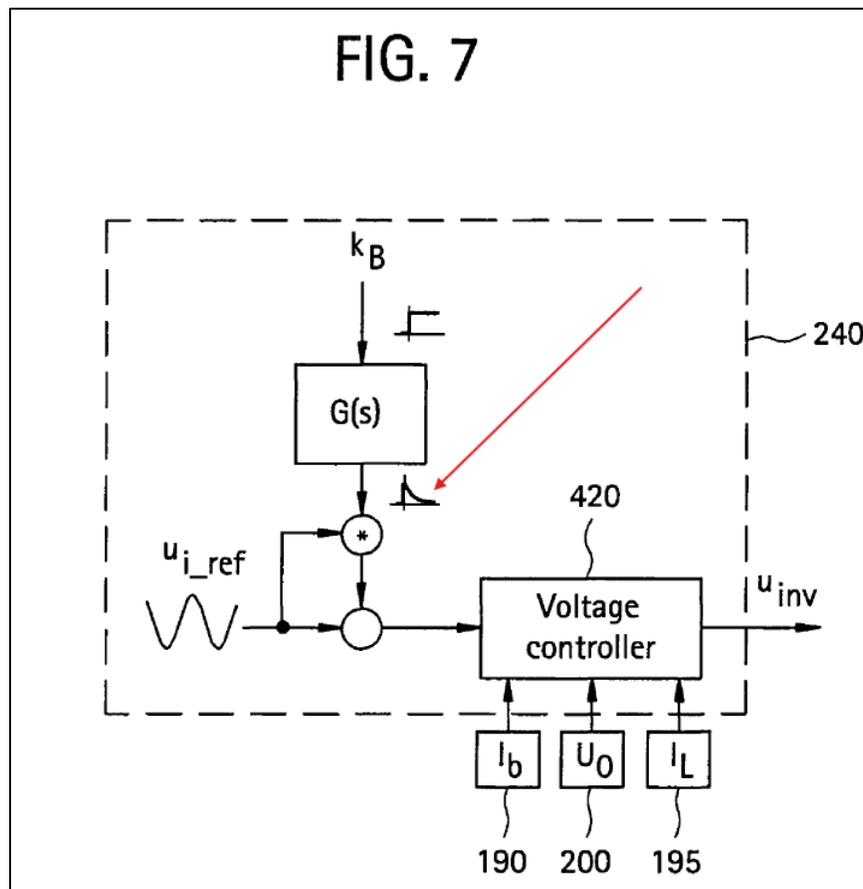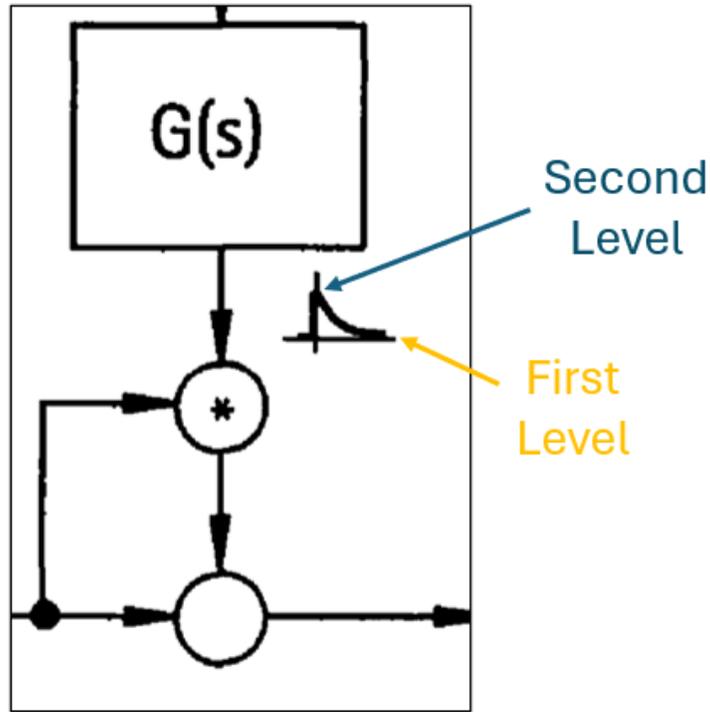
FIG. 7

Appendix D at Fig. 7 (annotations added). Because Colombi expressly teaches a general, configurable function G(s), a POSA would have been motivated to implement that function in response to the same fault signal that, in Shetler '124, triggers bypass transfer and voltage matching. Appendix C at ¶ 75.

Colombi and Shetler '124 disclose exactly the same type of transfer situation in which a critical failure in the UPS system necessitates a transfer to the bypass feed path. A POSA would thus have been especially motivated to configure Colombi's general function G(s) to be triggered by the fault detection taught in Shetler '124. Doing so merely applies Shetler '124's fault-initiated voltage adjustment to Colombi's known voltage control mechanism, yielding a predictable fault-based voltage control system. Appendix C at ¶ 76.

3. Dependent Claim 5

a. **"The uninterruptible power supply of claim 4, wherein: the fault detection module determines a type of the fault and indicates the type of the fault in the fault signal; and the control module switches the bypass switch from the non-bypass state to the bypass state based on the type of the fault."**

Colombi discloses a fault detection module that determines a type of the fault and indicates the type of the fault in the fault signal.

Further, Shetler '124 discloses a fault detection module that determines a type of the fault and indicates the type of the fault in the fault signal. As discussed above, Shetler '124 describes robust functionality for monitoring for faults within its system. Shetler '124 describes that the Comms DSP "handles the exchange of status, configuration and diagnostic information externally and internally to the control board," which includes information regarding "contactor position sensing, fan operational sensing, fuse status sensing, over temperature sensing, metering data (voltage, current, etc.), control data, and UPS operational status." Appendix E at 8:4-13. Likewise, Shetler '124 provides that "[c]ontrol information" is communicated such as "system commands (on, off, transfer, retransfer, etc.), contractor actuation signals, breaker actuation signals, and fan control." *Id.* at 8:13-15; Appendix C at ¶ 78.

Shetler '124 also teaches switching the bypass switch 5 from a non-bypass state to bypass state based on a specific type of fault. For example, Shetler '124's system can detect a "static switch driver board" fault condition, and then initiate "a latched transfer to bypass to prevent power interruption to the load." Appendix E at 10:25-38. In this specific "latched" bypass mode, "the UPS can return to normal operation only after user intervention." *Id.* In another example, Shetler '124 discloses switching to the bypass path in an "emergency" situation "also called automatic transfer." *Id.* at 38:26-29. Shetler '124 explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30. In an emergency transfer situation, if "the bypass

and inverter are not synchronized," "the output load [is] dropped momentarily (100 milliseconds or more) before the bypass re-energiz[es] the output." *Id.* at 38:34-41; Appendix C at ¶ 79.

4. Dependent Claim 6

a. Element [6.pre]: "The uninterruptible power supply of claim 5,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claims 1, 4, and 5. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Sections V.A.1, V.A.4, and V.C.3.

b. Element [6.1]: "wherein the control module: determines whether a switch over from the adaptive voltage control mode to the bypass mode is to be performed without a gradual decrease in the second alternating current voltage based on the type of the fault;

Colombi describes that "[i]n response to control system 175 detecting a fault on the bypass feed path 110, the SSM 120 is switched off, and after a defined time delay, the inverter 140 is switched on. In an embodiment, this time delay is computed using an optimal switching strategy depending on the load currents and the fault type." Appendix D at 5:40-46. Colombi further explains that "[a] real mains failure (in this case, loss of power from supply 112) is usually a complex phenomenon that may happen very far from the user location, and as a consequence may generate voltage oscillations due to the long transmission lines," and in such cases, "inverter 140 that has to be switched on from ECOMODE in such a situation is virtually in front of a short-circuit." *Id.* at 6:35-46. This would have demonstrated to a POSA that the decision to perform an immediate switch over—without a gradual decrease in voltage—depends on the nature and severity of the fault, as a gradual transition may not be feasible or desirable in the presence of

abrupt or severe faults such as short-circuits or open-circuits, where rapid restoration of voltage is necessary to maintain load stability and minimize disturbance. Appendix C at ¶ 80.

Shetler '124 also discloses that the control module determines whether a switch over from the adaptive voltage control mode to the bypass mode is to be performed without a gradual decrease in the second alternating current voltage based on the type of the fault. Shetler '124 teaches categorizing faults into two types—emergencies and non-emergencies—and transitioning into bypass mode based on the type of the fault. First, Shetler '124 discloses non-emergencies such as a fault in the "static switch driver board," in which case the control system initiates "a latched transfer to bypass to prevent power interruption to the load." Appendix E at 10:25-38. In this specific "latched" bypass mode, "the UPS can return to normal operation only after user intervention." *Id.* In such a "normal" or "manual" transfer, the inverter voltage is matched to the bypass voltage gradually, over a 5-cycle delay. *Id.* at 38:26-29, 38:42-46. Second, Shetler '124 also discloses emergencies that require immediate transfer to bypass *Id.* at 38:26-29. Shetler '124 explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30. In an emergency transfer situation, if "the bypass and inverter are not synchronized," "the output load [is] dropped momentarily (100 milliseconds or more) before the bypass re-energiz[es] the output." *Id.* at 38:34-41; Appendix C at ¶ 81.

A POSA would have been motivated to modify Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See* Appendix D at 38:34-41. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and

severity of the situation. For example, in the case of a non-emergency or anticipated transfer as taught in Shetler '124, the G(s) function could implement a gradual, controlled voltage ramp, minimizing disturbances to the load. Conversely, for severe faults, such as a short-circuit—which Colombi already discuss—Shetler '124 teaches that a stepwise voltage adjustment may be necessary to protect the system and maintain load continuity, even if this entails a voltage "drop." Appendix D at 38:34-41. Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a smooth ramp for routine or non-critical events and a more immediate transition for emergencies, in line with the fault-based switching logic disclosed in Shetler '124. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Appendix C at ¶ 82.

> c. **Element [6.2]: "gradually decreases the second alternating current voltage from the second level to the first level and switches the bypass switch from the non-bypass state to the bypass state when the fault is of a first type; and"**

Colombi discloses gradually decreasing the second alternating current voltage from the second level to the first level and switching the bypass switch from the non-bypass state to the bypass state. For example, Colombi teaches a smooth voltage decrease during switch from bypass to inverter mode. *Id.* at 8:25-27; *see also id.* at Fig. 7 (annotations added).
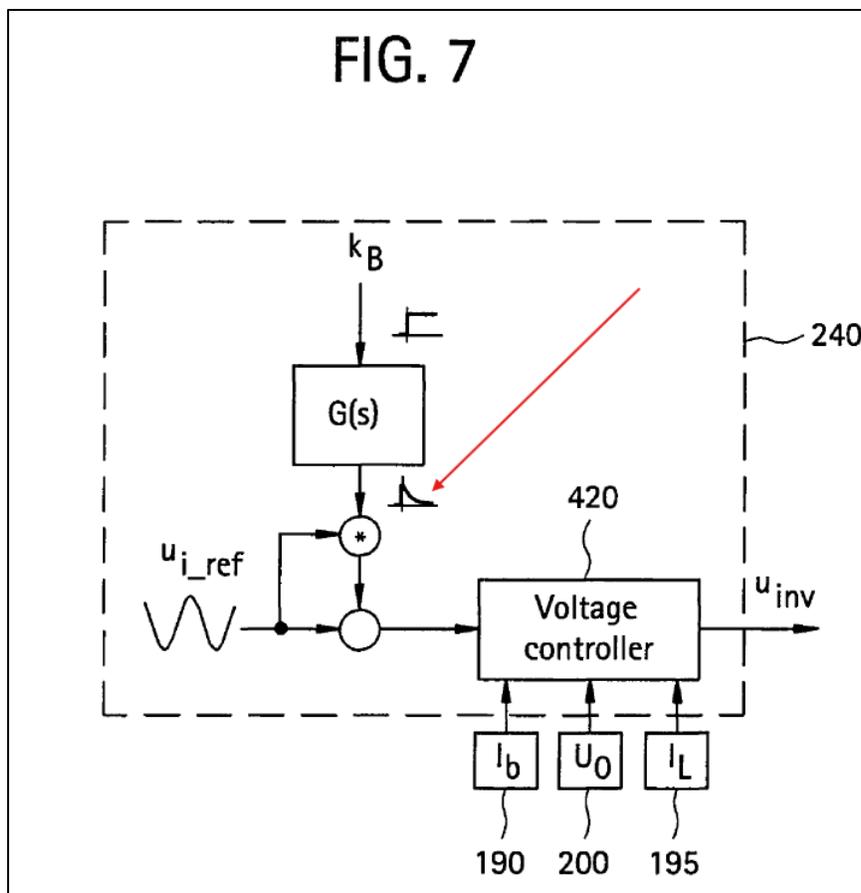
FIG. 7

Appendix D at Fig. 7 (annotations added); Appendix C at ¶ 83.

A POSA would have readily recognized the need to apply the smooth transition methodology when switching modes in the other direction, *i.e.*, from the inverter mode to the bypass mode. It was well known to a POSA that a sudden drop in voltage during UPS mode switch was dangerous. Appendix C at ¶ 84 (citing Appendix D at Background, 2:15-18). Therefore, a POSA would have readily understood that, when switching from the inverter mode to the bypass mode, it would be desirable to implement a smooth decline ("gradual[] decrease") in voltage from the second level to the first level. Furthermore, a POSA would have been able to achieve this gradual decrease by employing the same methodology disclosed in Colombi for implementing a smooth voltage boost. *Id.*

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Shetler '124 also discloses gradually decreasing the second alternating current voltage from the second level to the first level and switching the bypass switch from the non-bypass state to the bypass state when the fault is of a first type. Shetler '124 teaches two types of faults: emergencies and non-emergencies. Appendix E at 38:26-29. Shetler '124 teaches that for non-emergencies, the system initiates a "normal" or "manual" transfer, during which the inverter voltage is matched to the bypass voltage gradually, over a 5-cycle delay. *Id.*; *Id.* at 38:42-46. Appendix C at ¶ 85.

A POSA would have been motivated to use Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. For faults that are non-emergencies, the G(s) function in Colombi as illustrated in Fig 7 could be used without modification to implement the gradual decrease as taught by Shetler '124. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See id.* at 38:34-41. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and severity of the situation. For example, in the case of a non-emergency or anticipated transfer as taught in Shetler '124, the G(s) function could implement a gradual, controlled voltage ramp, minimizing disturbances to the load. Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a smooth ramp for routine or non-critical events. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Appendix C at ¶ 86.

d.   **Element [6.3]: "switches the bypass switch from the non-bypass state to the bypass state and adjusts the second alternating current from the second level to the first level without gradually decreasing the second alternating current voltage from the second level to the first level when the fault is of a second type."**

Colombi discloses the control module switching the bypass switch to the bypass state and adjusting the alternating current voltage from the second level to the first level without gradually decreasing the second alternating current voltage from the second level to the first level when the fault is of a second type. For example, Colombi describes using a static switch module instead of a mechanical breaker in order to "allow a fast 'entry' of the inverter 140 in case of a mains fault (that is loss of feed from power supply 117)[.]" Appendix D at 4:61–5:4; *see also id.* at 5:5-6 (describing that "[i]n this manner, it is possible to close (SSM7) 125, instantaneously."). Appendix C at ¶ 87.

A POSA would have readily recognized the need to apply the instantaneous voltage transition methodology when switching modes in the opposite direction, *i.e.*, from the inverter mode to the bypass mode. At the time of the '613 patent's alleged invention, it was well known that certain types of faults—including ones in the rectifier-inverter feed path—required an immediate switch to a different operative mode, even in light of the risks associated with a sudden voltage drop as discussed in Element 6.2. Appendix C at ¶ 88. Furthermore, Colombi describes a control strategy designed to "minimize the time during that the bypass feed path 110 and the inverter feed path 115 are paralleled, while avoiding a de-magnetization of the transformer 145, which helps to minimize the distortion of the output voltage Uo 200." Appendix D at 8:13-17. Thus, Colombi is designed for rapid, non-gradual transitions between feed paths in response to faults, providing a clear basis for a POSA to expect success in making the switch without a gradual voltage decrease. Appendix C at ¶ 88.

Shetler '124 also discloses adjusting the second alternating current from the second level to the first level without gradually decreasing the second alternating current voltage from the second level to the first level when the fault is of a second type. Shetler '124 teaches two types of faults: emergencies and non-emergencies. Appendix E at 38:26-29. Shetler '124 discloses that for faults that constitute emergencies, the control system initiates immediate transfer to bypass. *Id.* at 38:26-29. Shetler '124 further explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30. In an emergency transfer situation, if "the bypass and inverter are not synchronized," "the output load [is] dropped momentarily (100 milliseconds or more) before the bypass re-energiz[es] the output." *Id.* at 38:34-41; Appendix C at ¶ 89.

A POSA would have been motivated to modify Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. Specifically, a POSA would further configure Colombi's general G(s) function to have the form of a step-function so as to allow immediate response to an emergency. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See* Appendix D at 6:39-52. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and severity of the situation. For example, for severe faults, such as a short-circuit—which Colombi already discusses, Appendix D at 6:41-52—Shetler '124 teaches that a stepwise voltage adjustment may be necessary to protect the system and maintain load continuity, even if this entails a voltage "drop." Appendix E at 38:32-41. Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a more immediate transition for emergencies, in line with the fault-

based switching logic disclosed in Shetler '124. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Appendix C at ¶ 90.

5. Dependent Claim 7

a. Element [7.pre]: "The uninterruptible power supply of claim 6,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claims 1, 4, 5, and 6. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Sections V.A.1, V.A.4, V.C.3, and V.C.4.

b. Element [7.1]: "wherein the control module: determines whether at least one of the second alternating current voltage and an output voltage of the uninterruptible power supply matches at least one of an input voltage of the uninterruptible power supply and the first alternating current voltage; and"

Shetler '124 teaches that the control module: determines whether at least one of the second alternating current voltage and an output voltage of the uninterruptible power supply matches at least one of an input voltage of the uninterruptible power supply and the first alternating current voltage. For example, Shetler '124 describes that the control module determines whether the inverter output and the bypass output are "properly synchronized" in voltage magnitude and frequency before initiating a transfer from inverter power to bypass power. Appendix E at 38:26-33; Appendix C at ¶ 91.

A POSA reading Colombi in view of Shetler '124 would have been motivated to incorporate Shetler '124's teaching into Colombi for reasons set out above. Appendix E at 38:42-

49. A POSA combining Colombi with Shetler '124 would have had reasonable expectation of success for reasons set out above. Appendix C at ¶ 92.

           c.   **Element [7.2]: "switches the bypass switch from the non-bypass state to the bypass state when the at least one of the second alternating current voltage and the output voltage of the uninterruptible power supply matches the at least one of the input voltage of the uninterruptible power supply and the first alternating current voltage."**

Shetler '124 discloses switching the bypass switch from the non-bypass state to the bypass state when the at least one of the second alternating current voltage and the output voltage of the uninterruptible power supply matches the at least one of the input voltage of the uninterruptible power supply and the first alternating current voltage. Shetler '124 describes that the control module determines whether the inverter output and the bypass output are "properly synchronized" in voltage magnitude and frequency before initiating a transfer from inverter power to bypass power. Appendix E at 38:26-33. "If the bypass is qualified and the inverter and bypass are properly synchronized, then the bypass is turned on immediately." Appendix E at 38:31-33. Shetler teaches that this synchronization requirement exists to ensure a transition to bypass without an interruption or drop in voltage. *Id.* at 38:31–33 ("If the bypass is qualified and the inverter and bypass are properly synchronized, then the bypass is turned on immediately."); *see also id.* at 38:36-39 ("The unsynchronized transfer is called an interrupted transfer because the output load will be dropped momentarily (100 milliseconds or more) before the bypass re-energized the output."). Thus, Shetler teaches that the purpose of matching the output voltage of the UPS with the input voltage of the UPS is to guarantee a continuous seamless power handoff. Appendix C at ¶ 93.

Although Colombi's disclosure primarily addresses controlled transfer from the bypass path to the inverter path, a POSA would have been motivated to extend Colombi's system to provide reciprocal functionality for returning to the bypass path under the synchronized conditions

taught by Shetler '124. As Shetler '124 teaches, returning to bypass operation from inverter operation once synchronization is achieved avoids risks on the load or operation of the UPS from an interruption or "drop" of the load. *See id.* at 38:31–33. In view of Shetler's express teaching that synchronized conditions permit immediate and loss-reducing bypass operation, a POSA would have readily adapted Colombi's control architecture to switch from the UPS path back to the bypass path when the inverter output matches the bypass voltage. Such modification would have been a predictable and well-understood improvement to system efficiency without altering Colombi's fundamental mode-transfer principles. Appendix C at ¶ 94.

6. Dependent Claim 8

a. Element [8.pre]: "The uninterruptible power supply of claim 5,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claims 1, 4, and 5. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Sections V.A.1, V.A.4, and V.C.3.

b. Element [8.1]: "wherein the control module: determines whether an immediate switchover from the adaptive voltage control mode to the bypass mode is to be performed based on the type of the fault;"

Colombi describes that "[i]n response to control system 175 detecting a fault on the bypass feed path 110, the SSM 120 is switched off, and after a defined time delay, the inverter 140 is switched on. In an embodiment, this time delay is computed using an optimal switching strategy depending on the load currents and the fault type." Appendix D at 5:40-46. Colombi further explains that "[a] real mains failure (in this case, loss of power from supply 112) is usually a

complex phenomenon that may happen very far from the user location, and as a consequence may generate voltage oscillations due to the long transmission lines," and in such cases, "inverter 140 that has to be switched on from ECOMODE in such a situation is virtually in front of a short-circuit." *Id.* at 6:35-46. This would have demonstrated to a POSA that the decision to perform an immediate switch over—without a gradual decrease in voltage—depends on the nature and severity of the fault, as a gradual transition may not be feasible or desirable in the presence of abrupt or severe faults such as short-circuits or open-circuits, where rapid restoration of voltage is necessary to maintain load stability and minimize disturbance. Appendix C at ¶ 95.

Shetler '124 discloses that the control module determines whether an immediate switchover from the adaptive voltage control mode to the bypass mode is to be performed based on the type of the fault. Shetler '124 teaches categorizing faults into two types—emergencies and non-emergencies—and transitioning into bypass mode based on the type of the fault. First, Shetler '124 discloses non-emergencies such as a fault in the "static switch driver board," in which case the control system initiates "a latched transfer to bypass to prevent power interruption to the load." Appendix E at 10:25-38. In this specific "latched" bypass mode, "the UPS can return to normal operation only after user intervention." *Id.* In such a "normal" or "manual" transfer, the inverter voltage is matched to the bypass voltage gradually, over a 5-cycle delay. *Id.* at 38:26-29, 38:42-46. Second, Shetler '124 also discloses emergencies that require immediate switchover to bypass *Id.* at 38:26-29. Shetler '124 explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30. In an emergency transfer situation, if "the bypass and inverter are not synchronized," "the output load [is] dropped momentarily (100 milliseconds or more) before the bypass re-energiz[es] the output." *Id.* at 38:36-41. Appendix C at ¶ 96.

A POSA would have been motivated to modify Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See* Appendix E at 38:36-41. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and severity of the situation. For example, in the case of a non-emergency or anticipated transfer as taught in Shetler '124, the G(s) function could implement a gradual, controlled voltage ramp, minimizing disturbances to the load. Conversely, for severe faults, such as a short-circuit—which Colombi already discusses—Shetler '124 teaches that a stepwise voltage adjustment may be necessary to protect the system and maintain load continuity, even if this entails a voltage "drop." Appendix E at 38:36-41. Appendix C at ¶ 97.

Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a smooth ramp for routine or non-critical events and a more immediate transition for emergencies, in line with the fault-based switching logic disclosed in Shetler '124. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Such modification would have been a predictable and well-understood improvement to system efficiency without altering Colombi's fundamental mode-transfer principles since the modification merely involves configuring the G(s) function into a step function. Appendix C at ¶ 98.

      c.   **Element [8.2]: "ramps down the second alternating current voltage from the second level to the first level and switches the bypass switch from the non-bypass state to the first bypass state when the fault is not an immediate fault; and"**

Colombi discloses ramping down the second alternating current voltage from the second level to the first level and switching the bypass switch from the non-bypass state to the first bypass state. For example, Colombi teaches a smooth voltage decrease during switch from bypass to inverter mode. Appendix D at 8:25-27; *see also id.* at Fig. 7 (annotations added).
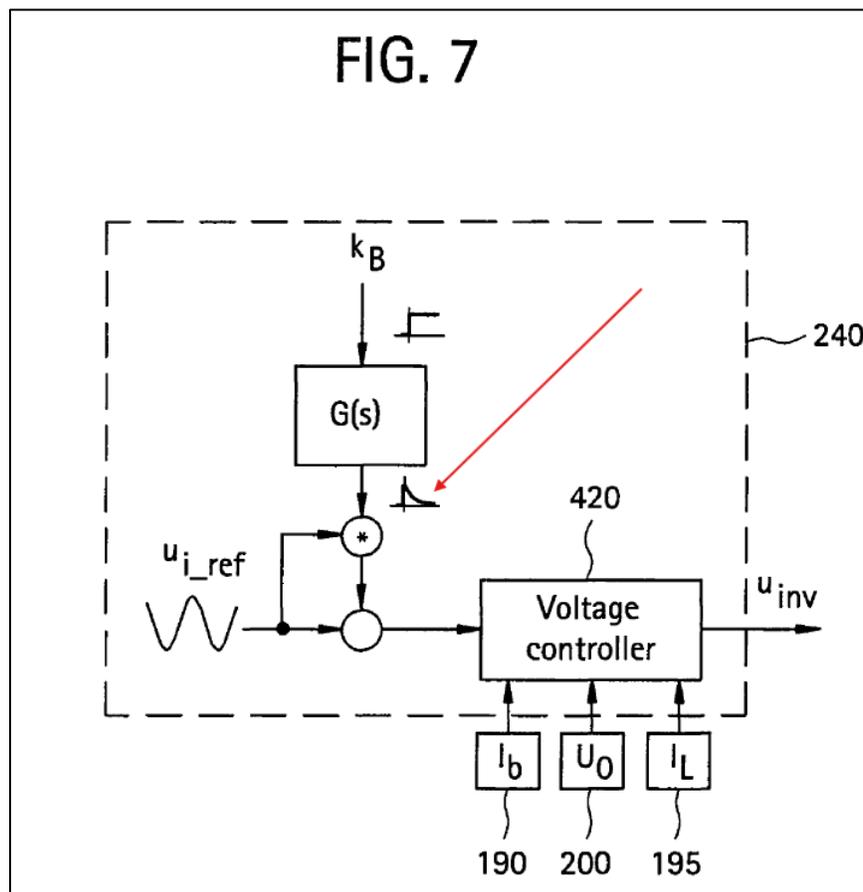
FIG. 7

Appendix D at Fig. 7 (annotations added); Appendix C at ¶ 99.

A POSA would have readily recognized the need to apply the smooth transition methodology when switching modes in the other direction, *i.e.*, from the inverter mode to the bypass mode. It was well known to a POSA that a sudden drop in voltage during UPS mode switch

was dangerous. Appendix C at ¶ 100 (citing Appendix D at Background, 2:15-18). Therefore, a POSA would have readily understood that, when switching from the inverter mode to the bypass mode, it would be desirable to implement a smooth decline ("gradual[] decrease") in voltage from the second level to the first level. Furthermore, a POSA would have been able to achieve this gradual decrease by employing the same methodology disclosed in Colombi for implementing a smooth voltage boost. *Id.*

Shetler '124 discloses ramping down the second alternating current voltage from the second level to the first level and switching the bypass switch from the non-bypass state to the first bypass state when the fault is not an immediate fault. Shetler '124 teaches two types of faults: emergencies and non-emergencies. Appendix E at 38:26-29. Shetler '124 teaches that for non-emergencies, the system initiates a "normal" or "manual" transfer, during which the inverter voltage is matched to the bypass voltage gradually, over a 5-cycle delay. *Id.* at 38:42-46; Appendix C at ¶ 101.

A POSA would have been motivated to use Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. For faults that are non-emergencies, the G(s) function in Colombi as illustrated in Fig 7 could be used without modification to implement the gradual decrease as taught by Shetler '124. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See* Appendix D at 38:36-41. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and severity of the situation. For example, in the case of a non-emergency or anticipated transfer as taught in Shetler '124, the G(s) function could implement a gradual, controlled voltage ramp,

minimizing disturbances to the load. Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a smooth ramp for routine or non-critical events. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Appendix C at ¶ 102.

        d.   **Element [8.3]: "switches the bypass switch from the non-bypass state to the bypass state and adjust the second alternating current voltage from the second level to the first level without ramping down the second alternating current voltage from a second voltage reference to the first level when the fault is an immediate fault."**

Colombi discloses the control module switching the bypass switch to the bypass state and adjusting the alternating current voltage from the bypass voltage to the normal inverter output voltage without gradually ramping the second alternating current voltage. For example, Colombi describes using a static switch module instead of a mechanical breaker in order to "allow a fast 'entry' of the inverter 140 in case of a mains fault (that is loss of feed from power supply 117)[.]" Appendix D at 4:61–5:4; *see also id.* at 5:5-6 (describing that "[i]n this manner, it is possible to close (SSM7) 125, instantaneously."). Appendix C at ¶ 103.

A POSA would have readily recognized the need to apply the instantaneous voltage transition methodology when switching modes in the other direction, *i.e.*, from the inverter mode to the bypass mode. At the time of the '613 patent's alleged invention, it was well known that certain types of faults—including ones in the rectifier-inverter feed path—required an immediate switch to a different operative mode, even in light of the risks associated with a sudden voltage drop as discussed in Element 6.2. Appendix C at ¶ 104. Furthermore, Colombi describes a control strategy designed to "minimize the time during that the bypass feed path 110 and the inverter feed

path 115 are paralleled, while avoiding a de-magnetization of the transformer 145, which helps to minimize the distortion of the output voltage Uo 200." Appendix D at 8:13-17. Thus, Colombi is designed for rapid, non-gradual transitions between feed paths in response to faults, providing a clear basis for a POSA to expect success in making the switch without a gradual voltage decrease. Appendix C at ¶ 104.

Shetler '124 discloses switching the bypass switch from the non-bypass state to the bypass state and adjusting the second alternating current voltage from the second level to the first level without ramping down the second alternating current voltage from a second voltage reference to the first level when the fault is an immediate fault. Shetler '124 teaches two types of faults: emergencies and non-emergencies. Appendix E at 38:26-29. Shetler '124 discloses that for faults that constitute emergencies, the control system initiates immediate switchover to bypass. *Id.* at 38:26-29. Shetler '124 further explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." *Id.* at 38:29-30. In an emergency transfer situation, if "the bypass and inverter are not synchronized," "the output load [is] dropped momentarily (100 milliseconds or more) before the bypass re-energiz[es] the output." *Id.* at 38:34-41. Appendix C at ¶ 105.

A POSA would have been motivated to modify Colombi's G(s) function to provide for customized voltage adjustment profiles in response to different fault conditions, as taught by Shetler '124. Specifically, a POSA would further configure Colombi's general G(s) function to have the form of a step-function so as to allow immediate response to an emergency. Colombi already categorizes different types of faults and teaches the different nature of different types of faults. *See* Appendix D at 38:36-41. Thus, a POSA would have recognized that the voltage adjustment governed by Colombi's G(s) function need not be a one-size-fits-all in response to all types of faults. Instead, the G(s) function could be further tailored to the nature and severity of the

situation. For example, for severe faults, such as a short-circuit—which Colombi already discuss, Appendix D at 6:41-51—Shetler '124 teaches that a stepwise voltage adjustment may be necessary to protect the system and maintain load continuity, even if this entails a voltage "drop." Appendix at 38:36-42. Thus, a POSA would have been motivated to configure Colombi's G(s) function to select or adapt its transient voltage response based on the specific fault signal received, implementing a more immediate transition for emergencies, in line with the fault-based switching logic disclosed in Shetler '124. This combination would ensure that the inverter output voltage adjustment is not only responsive to the occurrence of a fault, but is also optimized for the particular operational context, thereby enhancing system reliability and performance. Appendix C at ¶ 106.

7. Dependent Claim 9

a. Element [9.pre]: "The uninterruptible power supply of claim 8, wherein:"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claims 1, 4, 5, and 8. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Sections V.A.1, V.A. 4, V.C.3, and V.C. 6.

b. Element [9.1]: "the at least one device comprises the rectifier and the inverter; and"

Colombi discloses this limitation for the same reason that it discloses Element 1.1 and 1.2. *See supra* Section V.B.1.b, V.B.1.c (describing Element 1.1 and 1.2). Shetler '124 also expressly teaches an uninterruptible supply with a rectifier-inverter feed path along with a bypass feed path and a bypass switch:
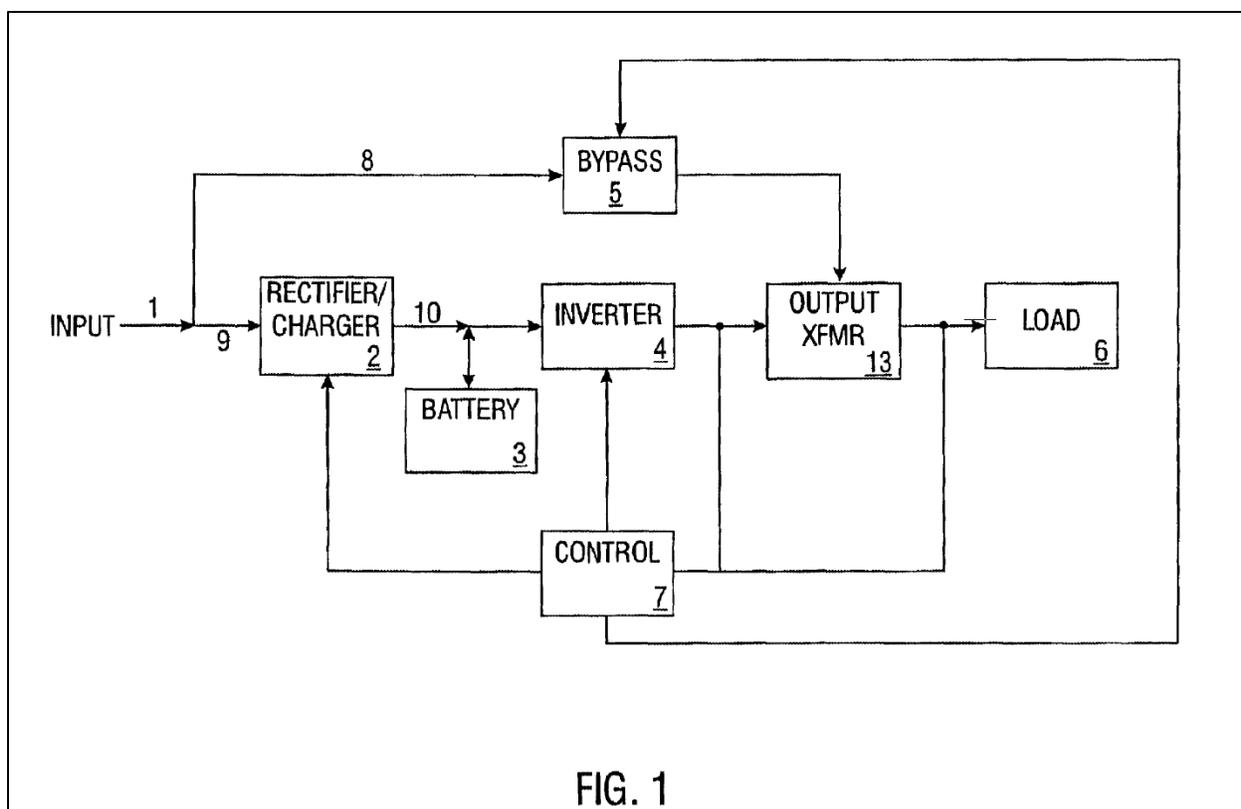
FIG. 1

Appendix E at Fig. 1; Appendix C at ¶ 107.

c.   Element [9.2]: "the immediate fault refers to a fault of at least one of the rectifier and the inverter."

Shetler also discloses an immediate fault, referring to a fault of at least one of the rectifier and the inverter. Shetler describes that "[i]f one of the UPS components fails," the UPS enters a bypass mode, and power flows from input 1 along the second power path 8. *See* Appendix E at 4:46-50. Shetler '124 explains that "[t]here are two situations in which inverter will transfer from inverter power to bypass power": "normal transfer, also called manual transfer" and "emergency transfer, also called automatic transfer." *Id.* at 38:26-29. Shetler '124 explains that "[a]n emergency transfer occurs when a fault is detected by the inverter DSP." Inverter DSP "controls the inverter 4." Appendix E at 7:61-62. Thus, a fault detected by the inverter DSP would refer to an immediate fault, or a fault of at least one of the rectifier and the inverter. Appendix C at ¶ 108.

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8.   Dependent Claim 10

      a.   Element [10.pre]: "The uninterruptible power supply of claim 1,"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

      b.   Element [10.1]: "further comprising an interface module that: generates a control signal indicating operation in a selected one of an automatic mode or a manual mode; and generates an enable signal indicating whether the adaptive voltage control mode is enabled, wherein the control module switches between operating in the bypass mode and the adaptive voltage control mode and switches the bypass switch between the bypass state and the non-bypass state based on the control signal and the enable signal."

Shetler '124 discloses an interface module that generates a control signal indicating operation in a selected one of an automatic mode or a manual mode. Sheter '124 discloses that its "Control board 15" interfaces with "Micro Monitor interface 19 to provide a user interface to the UPS." Appendix E at 7:42-43. Shetler '124 teaches that "[d]etailed UPS parameters and alarm statuses are available to the user through a graphics LCD." *Id.* at 11:41-42. Figure 4 shows the Micro Monitor Interface in detail:
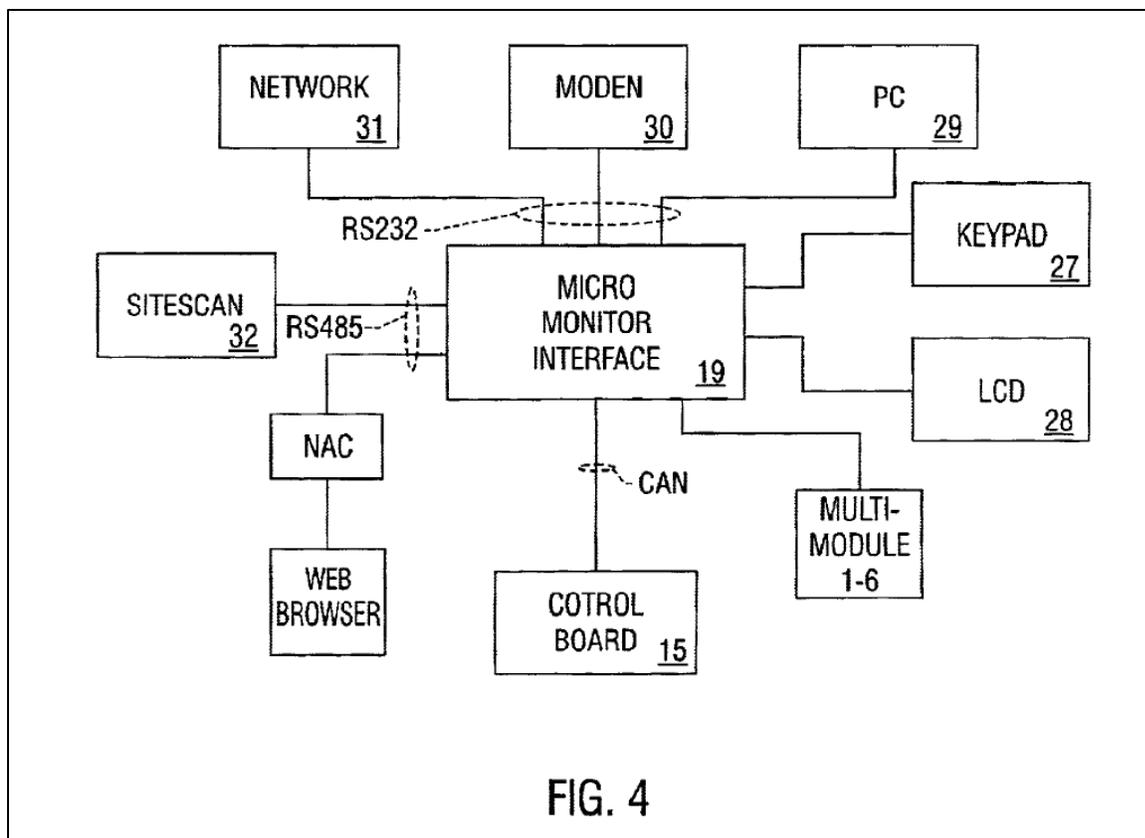
FIG. 4

Id. at Fig. 4; Appendix C at ¶ 109.

Shetler '124 also discloses that the interface module generates an enable signal indicating whether the adaptive voltage control mode is enabled, wherein the control module switches between operating in the bypass mode and the adaptive voltage control mode and switches the bypass switch between the bypass state and the non-bypass state based on the control signal and the enable signal. As discussed above, Shetler teaches that its "Control board 15" interfaces with "Micro Monitor interface 19 to provide a user interface to the UPS." Appendix E at 7:42-43; Appendix C at ¶ 110.

A POSA would have been motivated to apply Shetler '124's implementation details of using control and enable signals in Colombi's control system. Shetler '124 demonstrates the need for a control approach which provides "greater flexibility and more precise control of the uninterruptible power supply" (*Id.* at 1:16-19) by allowing the system to accept "startup commands

from the Micro Monitor user interface, supervising the necessary steps within the UPS," and enabling operation in either "manual startup mode" or "automatic startup mode." *Id.* at 13:57-67. Shetler '124 further teaches that the control module "issues a command to the Inverter DSP to begin firing the static switch SCRs" (*id*. at 15:1-6) and "verifies that startup of the static bypass switch is not inhibited by an existing fault condition," (*id*. at 14:31-34) thereby generating enable signals for specific control modes. This architecture allows the system to switch between bypass and adaptive voltage control modes and operate the bypass switch based on the control and enable signals, which would have motivated a POSA to adopt these features in Colombi's system to achieve improved operational reliability, user-selectable automation, and robust mode management. Appendix C at ¶ 111.

9. Dependent Claim 11

a. Element [11.pre]: "The uninterruptible power supply of claim 1"

To the extent the preamble is limiting, Colombi discloses an uninterruptible power supply as set forth in claim 1. For example, Colombi describes "[a] control system for an uninterruptible power supply (UPS) for servicing a load." Appendix D at Abstract; *see also id.* at 1:14-16 ("The present disclosure relates generally to uninterruptible power supplies (UPSs), and particularly to control systems for economic control thereof."); *see supra* Section V.A.1.

b. Element [11.1]: "wherein the control module comprises: a monitor control module that generates a control signal indicating operation in a selected one of an automatic mode or a manual mode, and"

Colombi discloses that the switching can be executed either automatically or manually. For example, Colombi describes that "[i]n an exemplary embodiment, the startup of rectifier 130 is accomplished automatically via switch (K4-circuit breaker) 155 or manually via switch (Q4-manual disconnect)[.]" Appendix D at 4:39-46. Colombi further describes that "manual bypass is

accomplished via switch (Q2) 170[.]" *Id.* As another example, Colombi discloses that "[d]isconnect switches (K4) 155, (K6) 160, (Ql) 165 and (Q2) 170 may be employed for additional protection and/or control and/or maintenance." *Id.* at 3:34-36. That is, Colombi teaches that manual disconnect can override normal UPS behavior under the automatic mode. Appendix C at ¶ 112.

Alternatively, it would have been obvious to a POSA to modify Colombi to generate a control signal indicating operation in a selected one of an automatic mode or a manual mode. This is clear because Colombi already discloses a flexible, software- and hardware-adaptable control system capable of monitoring system parameters and executing control strategies for UPS operation. Colombi describes both automatic monitoring and control (*e.g.,* fault detection, automatic switching between feed paths) and acknowledges the possibility of manual interventions (such as manual disconnects and circuit breakers for maintenance or startup). Given the widespread use of selectable automatic and manual modes in control systems for critical infrastructure to enhance operational flexibility, safety, and user control, a POSA would have recognized that adding a monitor control module to generate a control signal reflecting the current mode of operation would have been a routine and predictable enhancement, requiring only straightforward implementation using existing control logic and user interface techniques. Appendix C at ¶ 113.

Sheter '124 discloses that its "Control board 15" interfaces with "Micro Monitor interface 19 to provide a user interface to the UPS." Appendix E at 7:42-43. Shetler '124 teaches that "[d]etailed UPS parameters and alarm statuses are available to the user through a graphics LCD." *Id.* at 11:41-42. Figure 4 shows the Micro Monitor Interface in detail:
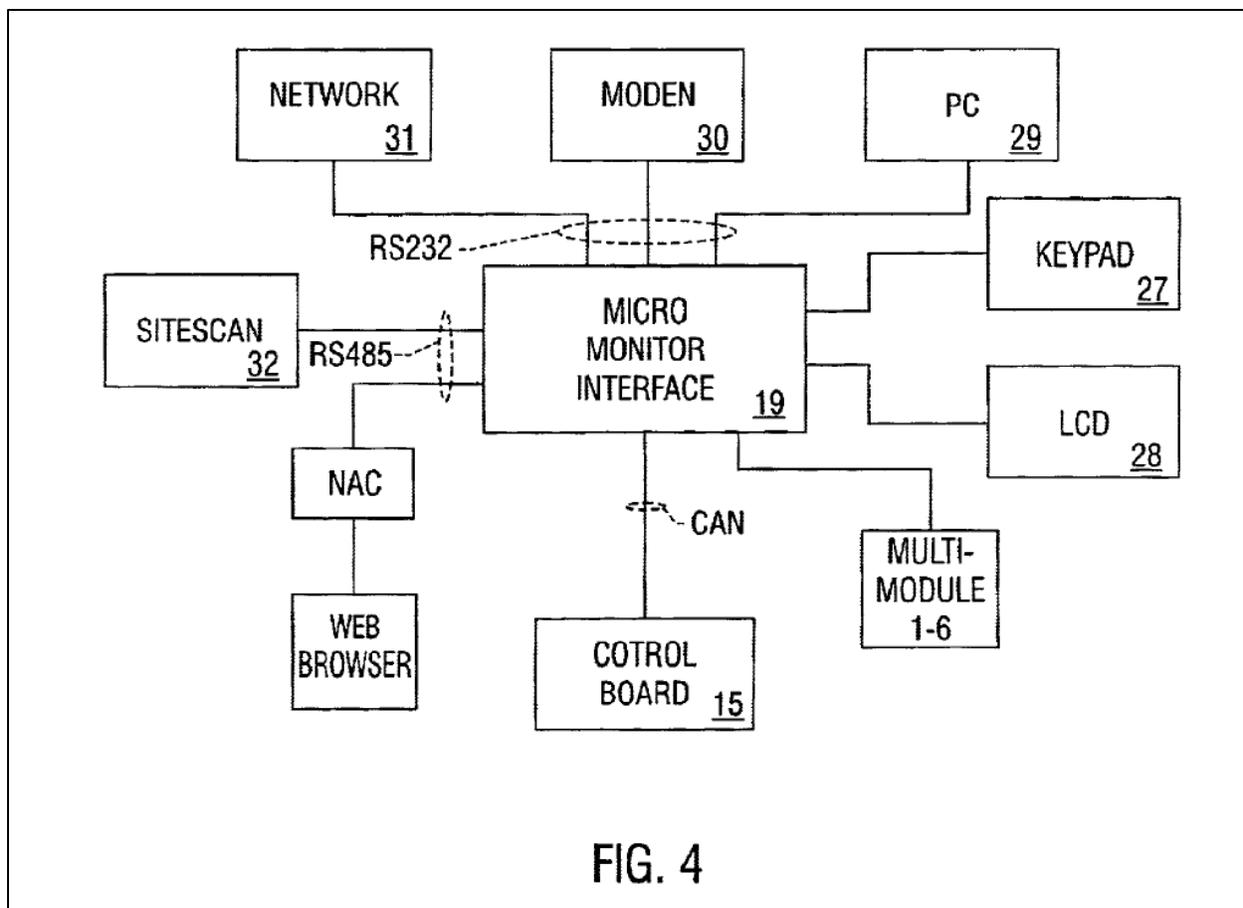
FIG. 4

Id. at Fig. 4; Appendix C at ¶ 114.

A POSA would have readily understood that the status of the UPS system regarding the automatic/manual mode (i.e., control signal) is critical information that should be displayed on the Micro Monitor Interface. Shetler '124 discloses that "[t]here are two situations in which inverter will transfer from inverter power to bypass power": "normal transfer, also called manual transfer" and "emergency transfer, also called automatic transfer." *Id.* at 38:26-39. It would have been obvious to a POSA that a UPS operator's confusion as to whether the UPS is in automatic or manual mode could lead to critical failures. For this information to be displayed on the Micro Monitor, the system must generate a control signal indicating operation in a selected one of an automatic mode or a manual mode. Appendix C at ¶ 115.

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c. **Element [11.2]: "generates an enable signal indicating whether the adaptive voltage control mode is enabled;"**

As discussed above in claim element 10.2, Colombi discloses that a monitor control module generates an enable signal indicating whether the adaptive voltage control mode is enabled. For example, Colombi describes that "output signals from control system 175 include a command signal (Sl) 225 to first switch 120, a command signal (S2) 230 to second switch 125, a command signal (S3) 235 to inverter 140, and a command signal (S4) 237 to rectifier 130." Appendix D at 4:1-5. Colombi further discloses that SSM command signal S1 is used in the process of switching from bypass mode to UPS mode. For example, Colombi describes that "[r]eferring back to the flow chart 300 of FIG. 5, if the output voltage monitoring is not OK for every phase (process step 310), the process of switching from bypass feed path 110 to the inverter feed path 115 is initiated by setting the SSM command signal Sl to 0 (process step 315)." *Id.* at 8:4-8. As discussed above, the switch from bypass feed path 11 to the inverter feed path 115 entails enabling adaptive voltage control mode. Appendix C at ¶ 116

It would have been obvious to a POSA to modify Colombi to generate an enable signal indicating whether the adaptive voltage control mode is enabled because Colombi already discloses a control system that continuously monitors output voltages and employs an adaptive voltage monitoring scheme to detect utility disturbances and trigger transitions between operating modes. Colombi describes the use of control signals and command signals for various operational states, including the activation and deactivation of different UPS modes and components. In such systems, it is standard practice to generate explicit enable or status signals to indicate when a particular control mode—such as adaptive voltage control—is active, both for internal logic coordination and for external monitoring or user interface purposes. Implementing an enable signal for the adaptive voltage control mode would have been a routine extension of the disclosed control

architecture, using established techniques for mode indication and system status signaling that are well known in the field of power electronics and control systems. Thus, the above disclosures from Colombi render this limitation obvious. Appendix C at ¶ 117.

Shetler '124 also discloses a monitor control module that generates an enable signal indicating whether the adaptive voltage control mode is enabled. Shetler teaches that its "Control board 15" interfaces with "Micro Monitor interface 19 to provide a user interface to the UPS." Appendix E at 7:42-43. A POSA would have also readily understood whether adaptive voltage control mode is currently on (i.e., the enable signal) is critical data that should be displayed on the Micro Monitor Interface. Appendix C at ¶ 118.

A POSA would have been motivated to apply Shetler '124's implementation details of using enable signal and a monitor to notify the user of important UPS operation data such as identification of the enablement of adaptive voltage control mode. It would have been obvious to a POSA that a UPS operator should be notified whether the adaptive voltage control mode is on or not, since it relates to key decision making related to voltage adjustment process dealt with in the adaptive voltage control mode. Appendix C at ¶ 119.

The ability to monitor and display the enablement status of adaptive voltage control mode allows operators to verify system functionality, respond appropriately to system events, and ensure the UPS is providing the intended level of protection and performance. A POSA would have recognized that to achieve this, the system would generate a control signal or status flag indicating whether the adaptive voltage control mode is active, which would then be communicated to the Micro Monitor or equivalent user interface for display. Implementing such functionality would have been well within the routine skill of a POSA, as Shetler '124 provides explicit guidance on the use of enable signals, status flags, and user interfaces for system monitoring and control,

making the integration of an enable signal for adaptive voltage control mode and its display on the user interface a straightforward and predictable design choice to enhance system usability, reliability, and operator awareness. Appendix C at ¶ 120.

      d.   **Element [11.3]: "power control module that monitors devices of the uninterruptible power supply and generates a fault signal when there is a fault in the uninterruptible power supply, and"**

Colombi describes a fault detection module that monitors the UPS device and generates a fault signal if the quality of power in the system deviates from predetermined ranges. For example, Colombi describes that "[i]n an embodiment of an improved ECOMODE UPS system 100, as herein disclosed, the load 105 is fed by the bypass feed path 110 (also referred to as the mains) while the control system 175 constantly monitors the quality of power in that path." Appendix D at 4:49-53. Colombi further describes that "[a]s soon as a problem in the bypass feed path 110 is detected, control system 175 switches the load 105 to the inverter feed path 115." *Id.* at 4:53-55. Colombi discloses a fault detection module that monitors the system's input voltage and generates a fault signal if the quality of power in the bypass feed path deviates from predetermined ranges. *See supra* Section V.A.4.b, V.B.4.b; Appendix C at ¶ 121.

Shetler '124 also discloses a fault detection module that monitors at least one parameter of a device of the uninterruptible power supply and generates a fault signal based on the at least one parameter. For example, Shetler '124 discloses a control module (control system 7) that includes "three digital signal processors ('DSPs') that perform all control computations for the UPS." Appendix E at 7:55-57. The "Comms DSP," one of the three DSPs in the control module, "controls high level system functions, including monitoring, and communications." *Id.* at 7:66-67. The Comms DSP monitors device parameters so that the "UPS system can automatically turn on the bypass switch if any abnormal conditions are detected that may jeopardize the quality of the power supplied to the load." *Id.* at 7:22-26. Shetler '124 describes that device parameters monitored by

the Comms DSP include: "contactor position sensing, fan operational sensing, fuse status sensing, over temperature sensing, metering data (voltage, current, etc.), control data, and UPS operational status." *Id.* at 8:4-13; Appendix C at ¶ 122.

Shetler '124 further discloses that based on the detected parameters, the fault detection module generates fault signals. For example, Shetler '124 discloses that the Comms DSP within the control system "also performs all metering functions and controls status and alarm signals." *Id.* at 8:1-2. Shetler '124 further describes that the Comms DSP "handles the exchange of status, configuration and diagnostic information externally and internally to the control board," which includes information regarding "contactor position sensing, fan operational sensing, fuse status sensing, over temperature sensing, metering data (voltage, current, etc.), control data, and UPS operational status." *Id.* at 8:4-13. Likewise, Shetler '124 provides that "[c]ontrol information" is communicated such as "system commends (on, off, transfer, retransfer, etc.), contractor actuation signals, breaker actuation signals, and fan control." *Id.* at 8:13-14; Appendix C at ¶ 123.

e. **Element [11.4]: "switches between the bypass mode and the adaptive voltage control mode based on the control signal, the enable signal, and the fault signal; and"**

Colombi discloses that control system 175 uses signals to switch the bypass switch to the bypass state when in the bypass mode and switches the bypass switch to the non-bypass state when in the UPS mode. For example, Colombi explains that "output signals from the control system 175 include a command signal (S1) 225 to first switch 120[.]" Appendix D at 4:1-5. "Switch 120" is the bypass switch responsible for switching between the bypass mode and the UPS mode. *See id.* at 4:46-48 ("transitions from the bypass feed path 110 to the inverter feed path 115 and vice-versa are controlled through the SSM 120 and breaker switch (K7) 125."). Appendix C at ¶ 124.

As discussed above, Colombi teaches UPS operation in manual/automatic modes and adaptive voltage control mode. A POSA would have readily understood that when operating these

modes, the control logic would make switching decisions based on the status of the control signal, enable signal and fault signal so that so that the system can reliably and safely transition between operational states. A POSA would have known that each mode may have distinct operational parameters, safety requirements, or response behaviors, and the system must ensure that transitions do not introduce instability or risk. Further, A POSA would have understood that reference to the relevant status signals can prevent conflicting commands or inadvertent mode changes that could compromise performance or safety. Therefore, a POSA reading Colombi would have found that Colombi implicitly teaches switching between the bypass mode and the adaptive voltage control mode based on the control signal, the enable signal, and the fault signal. Appendix C at ¶ 125

Shetler '124 also teaches switching between the bypass mode and the adaptive voltage control mode based on the control signal, the enable signal, and the fault signal. Appendix C at ¶ 126.

First, Shetler '124 teaches classification of faults into emergencies and non-emergencies, according to which the control system initiates either the automatic transfer or manual transfer. *See supra* V.C.8 (discussing Dependent Claim 10). A POSA would have readily understood that for this fault-type based classification to occur, the control system refers to a fault signal reflecting the fault type and switch between automatic and manual modes accordingly. Appendix C at ¶ 127. For stability of operation and user interface on Shetler '124's monitor, it would have been obvious to provide for a separate control signal that reflects whether the UPS is currently in manual mode or automatic mode. *Id.*

Second, Shetler '124 teaches adaptive voltage control mode and gradual/non-gradual ramping of inverter output voltage based on whether the adaptive voltage control mode is enabled or not. *See supra* V.C.4 (discussing Dependent Claim 6). The enablement of adaptive voltage

control mode also depends on the fault type triggering the switch of modes. *See id.* A POSA would have readily understood that the decision to switch to the adaptive control mode (or not) depends on the fault type (i.e. whether the fault situation warrants a gradual decrease or not). Thus, the POSA would have understood that the control system of Shetler '124 refers to a fault signal in making the switching decision. Appendix C at ¶ 128.

A POSA would have been motivated to apply Shetler '124's implementation details of using control signal, enable signal, and fault signal to switch between various operative modes of the UPS. A POSA would readily have recognized that by referring to these signals in making switching decisions, the system can dynamically respond to real-time events, such as faults or user commands, without introducing ambiguity or delay in mode transitions. Appendix C at ¶ 129. Further, incorporating these signals into the control logic allows for clear diagnostics and troubleshooting, as the system's current state and the rationale for any mode change are always traceable. *Id.*

Such a modification would have been a predictable and well-understood improvement to system efficiency without altering any of Colombi's fundamental UPS architecture. It would have simply required modifying the control logic minimally to refer to the status of control, enable, and fault signals when making switching decision, which Colombi already teaches expressly or implicitly. Appendix C at ¶ 130.

> **f.** **Element [11.5]: "a bypass switch control module that switches the bypass switch between the first bypass state and the non-bypass state based on the control signal, the enable signal, and the fault signal."**

Colombi discloses that control system 175 controls the bypass switch to switch between the bypass state and non-bypass state based on control, enable, and fault signals. For example, Colombi describes that "[i]n an embodiment, the control system 175 monitors inverter bridge

currents (lb) 190, inverter load currents (L) 195, inverter output voltages (Uo) 200, and load voltages (UL) 205, and provides control signals (S3) 235 to inverter 140 and (Sl) 225 to SSM 120." Appendix D at 5:31-35. Colombi further describes that "[b]ypass operation that switches in the bypass feed path 110 is possible through the first switch 120, which may be a Static Switch Module (SSM) for example." *Id.* at 4:35-38; Appendix C at ¶ 131.

Shetler '124 teaches switching between the bypass mode and the adaptive voltage control mode based on the control signal, the enable signal, and the fault signal. *See supra* Section V.C.9.e (discussing Claim Element 11.4). Shetler '124 also discloses a "static switch driver board," which is "the interface between the control board and the power carrying devices … in the UPS bypass path." Appendix E at 10:25-27. Under normal operation, the static switch driver board "operates the static switch through commands issued by the control board." *Id.* at 10:27-29. Under fault conditions, the static switch driver board is "designed to independently transfer the UPS to bypass" by "initiat[ing] a latched transfer to bypass to prevent power interruption to the load." *Id.* at 10:29-35; Appendix C at ¶ 132.

A POSA would have been motivated to apply Shetler '124's implementation details of using control signal, enable signal, and fault signal to switch between various operative modes of the UPS. A POSA would readily recognize that by referring to these signals in making switching decisions, the system can dynamically respond to real-time events, such as faults or user commands, without introducing ambiguity or delay in mode transitions. Appendix C at ¶ 133. Further, incorporating these signals into the control logic allows for clear diagnostics and troubleshooting, as the system's current state and the rationale for any mode change are always traceable. *Id.*

Such a modification would have been a predictable and well-understood improvement to system efficiency without altering any of Colombi's fundamental UPS architecture. It would have simply involved modifying the control logic minimally to refer to the status of control, enable, and fault signals when making switching decision, which Colombi already teaches expressly or implicitly. Appendix C at ¶ 134.

10. Dependent Claim 17

a. **"The method of claim 16, further comprising: monitoring at least one parameter of a device of the uninterruptible power supply and generating a fault signal based on the parameter; and adjusting the second alternating current voltage from the second voltage level to the first voltage level based on the fault signal."**

Colombi in view of Shetler '124 renders this claim obvious for the same reasons that Claim 4 is obvious. *See supra* Section V.C.2 (describing Claim 4); Appendix C at ¶ 135.

11. Dependent Claim 18

a. **"The method of claim 17, further comprising: determining a type of the fault and indicating the type of the fault in the fault signal; and switching the bypass switch from the non-bypass state to the bypass state based on the type of the fault."**

Colombi in view of Shetler '124 renders this claim obvious for the same reasons that Claim 5 is obvious. *See supra* Section V.C.3 (describing Claim 5); Appendix C at ¶ 136.

12. Dependent Claim 19

a. **"The method of claim 18, further comprising: determining whether a switchover from an adaptive voltage control mode to the bypass mode is to be performed without a gradual decrease in the second alternating current voltage based on the type of the fault; gradually decreasing the second alternating current voltage from the second voltage level to the first voltage level and switching the bypass switch from the non-bypass state to the bypass state when the fault is of a first type; and switching the bypass switch from the non-bypass state to the bypass state without gradually decreasing the second alternating current voltage from the second voltage level to the first voltage level when the fault is of a second type."**

Colombi in view of Shetler '124 renders this claim obvious for the same reasons that Claim 6 is obvious. *See supra* Section V.C.4 (describing Claim 6); Appendix C at ¶ 137.

13. Dependent Claim 20

a. **"The method of claim 19, further comprising: determining whether at least one of the second alternating current voltage and an output voltage of the uninterruptible power supply matches at least one of an input voltage of the uninterruptible power supply and the first alternating current voltage; and switching the bypass switch from the non-bypass state to the bypass state when the at least one of the second alternating current voltage and the output voltage of the uninterruptible power supply matches the at least one of the input voltage of the uninterruptible power supply and the first alternating current voltage."**

Colombi in view of Shetler '124 renders this claim obvious for the same reasons that Claim 7 is obvious. *See supra* Section V.C.5 (describing Claim 7); Appendix C at ¶ 138.

VI. CONCLUSION

For the above reasons, the references discussed herein raise substantial and new questions of patentability with respect to claims 1–11 and 16–20 of the '613 patent. These references each were published or filed prior to the earliest potential priority date of the '613 patent. These

references therefore are prior art statutorily under 35 U.S.C. § 102 and substantively render claims 1–11 and 16–20 of the '613 patent unpatentable for the reasons discussed above.

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Respectfully Submitted,

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