UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

LS CABLE & SYSTEM LTD.
Patent Owner.

Patent No. 8,013,568

Inter Partes Review No. IPR2025-01141

DECLARATION OF DR. JOSHUA R. SMITH

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Petitioner's Exhibit List

Exhibit Description	Exhibit #
U.S. Patent No. 8,013,568 to Park et al. ("the '568 Patent")	EX1001
Ex Parte Reexamination Certificate No. 8,013,568 C1	EX1002
Prosecution History of U.S. Patent No. 8,013,568	EX1003
Prosecution History of *Ex Parte* Reexamination, Control No. 96/000,355 (Part 1 of 2)	EX1004A
Prosecution History of *Ex Parte* Reexamination, Control No. 96/000,355 (Part 2 of 2)	EX1004B
Declaration of Dr. Joshua R. Smith in Support of Petition for *Inter Partes* Review of U.S. Patent No. 8,013,568	EX1005
Curriculum Vitae of Dr. Joshua R. Smith	EX1006
U.S. Patent No. 7,522,878 to Baarman ("Baarman-878")	EX1007
U.S. Patent Appl. No. 10/689,499 ("Baarman-499")	EX1008
U.S. Patent Appl. No. 10/689,224	EX1009
U.S. Patent Appl. No. 10/689,375	EX1010
U.S. Patent Appl. No. 10/246,155	EX1011
Datasheet for NCP1800, Single-Cell Lithium Ion Battery Charge Controller, Rev. 4 (May 2003) ("NCP1800 Datasheet")	EX1012
U.S. Patent No. 7,791,319 to Veselic et al. ("Veselic")	EX1013
U.S. Patent No. 7,518,267 to Baarman ("Baarman-267")	EX1014
U.S. Patent Appl. No. 10/689,154	EX1015

Exhibit Description	Exhibit #
P. SCHERZ ET AL., PRACTICAL ELECTRONICS FOR INVENTORS (McGraw-Hill 2000)	EX1016
R. CHABAY ET AL., MATTER & INTERACTIONS II: ELECTRIC AND MAGNETIC INTERACTIONS (John Wiley & Sons Inc. 2nd Ed. 2007)	EX1017
A. TANENBAUM, COMPUTER NETWORKS (Prentice Hall PTR 4th Ed. 2007)	EX1018
P. HOROWITZ AND W. HILL, THE ART OF ELECTRONICS (Cambridge Univ. Press 2nd Ed. 1989) ("Horowitz")	EX1019

I, Joshua R. Smith, make this declaration in connection with the proceeding identified above.

I. INTRODUCTION

1. I have been retained by counsel for Apple Inc. ("Petitioner" or "Apple") in connection with the proceeding identified above. I submit this declaration in support of Apple's Petition for *Inter Partes* Review of United States Patent No. 8,013,568 (EX1001), as amended by an *ex parte* reexamination certificate (EX1002) issued Sept, 28, 2023 (together, "'568 patent"). I understand that LS Cable & System Ltd. ("Patent Owner" or "LS Cable") states that it is the owner of the '568 Patent.

2. I have reviewed and am familiar with the '568 patent, which issued on Sept. 6, 2011. I also understand that the '568 patent underwent an *ex parte* reexamination, which resulted in an *ex parte* reexamination certificate (EX1002) that issued on Sept. 28, 2023. I understand that, as reflected by the *ex parte* reexamination certificate, the '929 patent includes 57 claims (claims 1 and 3-58). I also understand that the Petition for *inter partes* review that accompanies this Declaration (the "Petition") seeks to cancel claims 1 and 3-58 (the "challenged claims") of the '568 patent.

3. In preparation for this Declaration, I reviewed the exhibits provided by the Petitioner, including the '568 Patent. In addition to the above exhibits and

other documents, my opinions herein are based upon my personal knowledge, professional judgment, education, and experience gained through my years as a computer scientist, professor, and consultant.

4. The ’568 patent is generally directed to battery charger circuits, such as for wireless inductive battery charging for devices such as mobile phones. (EX1001, Abstract.) I am familiar with the technology described in the ’568 patent both as of its earliest possible priority date of July 29, 2005, and its actual U.S. filing date of June 17, 2008.

5. I have been asked to consider how a person of ordinary skill in the art (“POSITA”) would have understood the challenged claims in light of the disclosure of the ’568 patent. I also have been asked to consider how a POSITA would have understood the following prior art references:

Prior Art Reference	Abbreviation
U.S. Patent No. 7,522,878 to Baarman	Baarman-878 (EX1007)
Datasheet for NCP1800, Single-Cell Lithium Ion Battery Charge Controller, Rev. 4 (May 2003)	NCP1800 Datasheet (EX1012)
P. HOROWITZ AND W. HILL, THE ART OF ELECTRONICS (Cambridge Univ. Press 2nd Ed. 1989)	Horowitz (EX1019)
U.S. Patent No. 7,791,319 to Veselic et al.	Veselic (EX1013)
U.S. Patent No. 7,518,267 to Baarman	Baarman-267 (EX1014)

6. Further, I have been asked to consider and provide my technical review, analysis, insights, and opinions regarding whether a POSITA would have understood the disclosures of the above references to render obvious the challenged claims.

7. I am being paid $750 per hour for my work on this matter. My compensation is not dependent on the outcome of this *inter partes* review and in no way affects the substance of my statements in this declaration.

8. I reside in Seattle, Washington, USA.

II. SUMMARY OF GROUNDS

9. I understand that the Petition for *inter partes* review of the ’568 patent asserts the following grounds of unpatentability:

Ground	35 U.S.C. §	Claims(s)	Prior Art Reference(s)
1	103	1, 5, 7, 8, 11, 13-19, 21, 23, 25-49, 52, 54-58	Baarman-878, NCP1800 Datasheet, Horowitz
2	103	3, 4, 6, 9, 10, 12, 20, 22, 24, 50, 51, 53	Baarman-878, NCP1800 Datasheet, Horowitz, Veselic
3	103	1, 3, 7-9, 11, 12, 30-34, 48-50, 52, 53	Baarman-267, Veselic

III. QUALIFICATIONS AND EXPERTISE

10. In formulating my opinions, I have relied upon my knowledge, training, and experience. My qualifications are stated more fully in my *curriculum vitae*, which has been provided as EX1006. Here, I provide a brief summary of my qualifications.

11. I am the Milton and Delia Zeutschel Professor at the University of Washington, jointly appointed in the Department of Electrical and Computer Engineering and in the Allen School. I am providing this Declaration as an independent professional working through my consulting company, Sensor Expert LLC, not as a representative of the University of Washington or any other organization.

12. I have at least twenty years of experience with wireless power technology. I have worked on wireless power projects as an engineer, in academic research, and as a supervisor of academic research. I am a Fellow of the National Academy of Inventors (NAI). According to the NAI, "Election to NAI Fellow status is the highest professional distinction accorded solely to academic inventors." I am also a Fellow of the Institute of Electrical and Electronic Engineers ("IEEE"). According to the IEEE, the "Grade of Fellow is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments." The specific citation in my elevation to Fellow was for

"contributions to far- and near-field wireless power, backscatter communication and electric field sensing." At most one tenth of one percent of the worldwide membership can join the ranks of IEEE Fellow each year.

13. I received my Ph.D. and S.M. degrees in Media Arts and Sciences from the Massachusetts Institute of Technology. This was an interdisciplinary program at the MIT Media Lab. As part of this program, my group, led by Neil Gershenfeld, engaged with the fields of Applied Physics, Electrical Engineering, and Computer Science. I also received a M.A. in Physics from Cambridge University, and dual B.A. degrees in Computer Science and Philosophy from Williams College.

14. From 2004 to 2011, I worked at Intel Corporation, where I rose to the rank of Principal Engineer before leaving Intel to become a professor. At Intel, I started the Wireless Identification and Sensing Platform ("WISP") project, in which we designed and built wirelessly powered and wirelessly charged RFID tags from the ground up. I also led Intel's research on applications of wireless power technology for laptops.

15. At Intel, I also served on a committee that made patent filing decisions about wireless technology, including wireless power, for the entire company. I also served on Intel's Strategic Patent Team for wireless technology, which allocated patent filing budgets for each year for the company among various

technical subjects within the wireless area. Prior to Intel, I was Chief Scientist at Escher Group and Director of Escher Labs, where I worked on low frequency RFID systems that relied on near field capacitive coupling between the tag and the reader for wireless power transfer.

16. In 2011, I joined the University of Washington as an Associate Professor. I received tenure in 2014, and was promoted to Professor and awarded the Milton and Delia Zeutschel Professorship in 2017. At the University of Washington, I currently lead research in a number of areas including wireless power transfer, backscatter communication, and other topics. My research in these areas has been funded by Federal agencies including the National Science Foundation (NSF), National Institutes for Health (NIH), the Department of Defense (DoD), Defense Advanced Research Projects Agency (DARPA), the Advanced Research Projects Agency for Energy (ARPA-E), and the National Aeronautics and Space Administration (NASA). I was the General Chair of the 2019 IEEE RFID conference, a leading venue for academic and industrial research on RFID. At UW, I created a new course on wireless power transfer, one of the only ones in the US as far as I know. I also teach or have taught wireless communication, analog electronics, digital circuits and systems, and other topics. I am also the faculty coordinator for Electrical and Computer Engineering Department's Professional Masters' Program. In this role, I make decisions about

which courses are offered and often who will teach them. I have also co-founded three startup companies, each based on technology developed in my lab.

17. I am a named inventor on 56 U.S. patents and at least 16 foreign patents. At least 27 of my U.S. patents and 13 of my foreign patents have been licensed. I have published over 176 articles and edited one book entitled "Wirelessly Powered Sensor Networks and Computational RFID." My work has been cited over 26,000 times, and my "H-index," which measures publication impact, is 79. My four most cited works all relate to wireless power technology or wirelessly powered systems. I have published several papers describing the design, implementation, and evaluation of wirelessly charged sensor systems. A company I co-founded sells wireless charging technology, which includes fully programmable battery chargers that follow proper charge cycles for a wide range of batteries including all common lithium variants. Output voltage and current are also programmable to help customers optimize charging for maximum battery lifespan. In addition, the company's products can perform wired battery charging, allowing operators to change parameters such as voltage and current "on the fly". This can dramatically extend battery lifespan by avoiding maximum charge voltage and speed when it is not necessary.

IV. LEGAL UNDERSTANDING

A. My Understanding of Claim Construction

18. I have been advised and understand that claim construction is a matter of law and that the final claim construction will ultimately be determined by the Patent Trial and Appeal Board (the "Board"). I have been advised and understand that patent claims are construed from the perspective of one of ordinary skill in the art at the time the claimed invention was made. I have further been advised and understand that, in an *inter partes* review, patent claims are to be construed according to the methodology set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). In performing my analysis and rendering my opinions, I have interpreted claim terms by giving them the ordinary and customary meaning they would have to the POSITA reading the '568 patent as of July 29, 2005, and in light of its specification and file history (including the file history of the *ex parte* reexamination).

B. A Person Having Ordinary Skill in the Art

19. I have been advised and understand that a POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity, not an automaton. With this understanding, a POSITA at the time of the invention claimed in the '568 patent would have had a Bachelor's degree and a Master's degree in Electrical Engineering, Computer Engineering, Physics, or a related field, as well as one to two years of academic or

industry experience in power electronics or battery charging or comparable industry experience.

C. My Understanding of Obviousness

20. I have been advised and understand that a claimed invention is unpatentable if the differences between the invention and the prior art are such that, at the time the invention was made, the subject matter as a whole would have been obvious at the time the invention was made to a POSITA to which the subject matter pertains. This means that even if all of the requirements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be invalid.

21. It is my understanding that obviousness is a question of law based on underlying factual findings: (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; (3) the level of skill in the art; and (4) objective considerations of non-obviousness. I understand that for a single reference or a combination of references to render the claimed invention obvious, a POSITA must have been able to arrive at the claims by altering or combining the applied references.

22. I also understand that prior art references can be combined under several different circumstances. For example, it is my understanding that one such circumstance is when a proposed combination of prior art references results in a

system that represents a predictable variation, which is achieved using prior art elements according to their established functions.

23. I also understand that when considering the obviousness of a patent claim, one should consider whether a teaching, suggestion, or motivation to combine the references exists so as to avoid impermissibly applying hindsight when considering the prior art. I understand this test should not be rigidly applied, but that the test can be important to avoiding such hindsight.

V. THE ’568 PATENT

A. Background of the ’568 Patent

24. The ’568 patent relates to contactless battery charging. Contactless chargers, such as described in the patent, utilize induced electric current to wirelessly charge batteries for devices such as mobile phones. (EX1001, Abstract, 1:9-63.) In some prior art battery chargers, a charger and a battery can be coupled in relatively fixed positions (*e.g.*, held in place by grooves and protrusions). (EX1001, 2:49-3:3.) The ’568 patent purports to improve on prior art chargers by “overcoming the restriction of relative positions” of the battery and charger, for the “convenience of the user,” while preventing overvoltage conditions that can damage the battery. (EX1001, 3:4-39.)

B. Prosecution History of the ’568 Patent

25. The prosecution of the ’568 patent was not robust; the originally filed claims were allowed without a single Office Action, and only thirteen references were considered by the Examiner. (EX1003, 28-33; EX1001, (56).)

26. A supplemental examination proceeding was filed on March 12, 2021, upon which *ex parte* reexamination of the claims was ordered. (EX1004A, 576.) At its conclusion, a reexamination certificate was issued, reflecting that claim 2 is canceled, claims 1, 3, 4, 7-13, 15-19, 21, and 23 are amended; and new claims 25-58 are added. (EX1002, 2.)

C. Claim Construction

27. As discussed above, I understand that, during an *inter partes* review, words in a claim are given their ordinary and customary meaning, which is the meaning understood by a POSITA at the time of the alleged invention after reading the entire patent. In performing my analysis and rendering my opinions, I have interpreted claim terms by giving them the ordinary and customary meaning they would have to the POSITA reading the ’568 patent as of July 29, 2005, and in light of its specification and file history.

28. I do not believe any claim construction is necessary for the purposes of the Petition. I believe the challenged claims are unpatentable under any reasonable interpretation of the claim language.

D. Priority Date of the Challenged Claims

29. The ’568 patent issued from U.S. Patent Application No. 11/997,272, which was filed in the United States under 35 U.S.C. § 371(c) on June 17, 2008. The application claims priority to Korean Patent Application No. 10-2005-0069871, filed July 29, 2005; and Korean Patent Application No. 10-2006-0038960, filed April 28, 2006. Therefore, the earliest possible priority date of the challenged claims is July 29, 2005.

VI. TECHNICAL ANALYSIS OF PRIOR ART

A. Ground 1: Claims 1, 5, 7, 8, 11, 13-19, 21, 23, 25-49, 52, and 54-58 are Rendered Obvious Based On Baarman-878 and NCP1800 Datasheet in View of Horowitz

30. It is my view that Baarman-878 in view of NCP1800 Datasheet and Horowitz teaches each and every limitation of claims 1, 5, 7, 8, 11, 13-19, 21, 23, 25-49, 52 of the ’568 Patent, for the reasons set forth below.

1. Summary of Baarman-878

31. Baarman-878 is a U.S. Patent issued to inventor David W. Baarman. The underlying application (Appl. No. 10/689,148) was filed on October 20, 2003; published as U.S. Patent Appl. Pub. 2004/0130915 on July 8, 2004; and issued as a U.S. Patent on April 21, 2009. Baarman-878 is thus prior art to the ’568 patent under at least 35 U.S.C. §§102(a), (b), and (e).

32. Baarman-878 discloses “Contactless energy transmission systems (CEETS)” in which a power supply charges and communicates with a remote

device, such as a chargeable battery. (EX1007, 1:33-51.) Such systems can use magnetic induction to wirelessly transfer energy from a primary winding in the power supply to a secondary winding in the battery. (EX1007, 1:33-51.) The power supply can be adapted in response to signals received wirelessly from the remote device. (EX1007, 2:53-3:21.) For example, the rail voltage, frequency, and/or duty cycle of the AC signal provided to the primary winding can be adjusted in response to load information received from a controller of the remote device. (EX1007, 2:53-3:21.)

33. Baarman-878 incorporates by reference three contemporaneously-filed patent applications: Appl. No. 10/689,499 (EX1008); Appl. No. 10/689,224 (EX1009); and Appl. No. 10/689,375 (EX1010). (EX1007, 1:25-29.) Baarman-878 also incorporates by reference Appl. No. 10/246,155 (EX1011). (EX1007, 3:58-63.)

34. Baarman-878 is analogous art to the claimed invention at least because it is directed to solving the same problem (contactless battery charging) in the same field of endeavor (electronic circuits) as the ’568 patent; and provides disclosures analogous to those of the ’568 patent. For example, Baarman-878 describes a contactless power supply for charging a remote device having a battery (*e.g.*, a mobile phone); and utilizing wireless feedback from the remote device to adjust the operation of the power supply. (*See, e.g.*, EX1007, 2:32-3:31, Abstract.)

This is analogous to the ’568 patent’s wireless charger for charging a device such a mobile phone, and using wireless feedback from the device to control the charger. (EX1001, 1:19-63, Abstract.) Baarman-878 is thus reasonably pertinent to the problem of battery charger design faced by the inventor of the ’568 patent.

2. Summary of NCP1800 Datasheet

35. NCP1800 Datasheet is a May 2003 publication by ON Semiconductor describing the structure and operation of the NCP1800, which is a “constant current, constant voltage (CCCV) lithium ion battery charge controller.” (EX1012, 1.) NCP1800 Datasheet is thus prior art to the ’568 patent under at least 35 U.S.C. § 102(a) and (b).

36. The NCP1800 “provides the necessary control functions for charging [lithium-ion] batteries precisely and safely.” (EX1012, 10.) It “features the constant current and constant voltage method (CCCV) of charging.” (*Id.*) The NCP1800 includes overvoltage protection features, and senses an input voltage from a power source (V_{CC}) and an output voltage to a battery (V_{SNS}) to determine whether those voltages fall within acceptable ranges. (*Id.*, 1-4, 7, 8.)

37. NCP1800 Datasheet is analogous art to the claimed invention at least because it is directed to solving the same problem (battery charging) in the same field of endeavor (electronic circuits) as the ’568 patent. (EX1012, 1, 7.) For example, the CCCV battery charge controller disclosed in the NCP1800 Datasheet

is analogous to the constant voltage/constant current supplier 290 disclosed in the ’568 patent, and performs the analogous function of charging a battery cell in a constant voltage or constant current mode. (*See, e.g.*, EX1012, 1, 7; EX1007, 7:33-42.) NCP1800 Datasheet is thus reasonably pertinent to the problem of battery charger design faced by the inventor of the ’568 patent.

3. Summary of Horowitz

38. Horowitz is an electronics textbook authored by Harvard faculty and published in 1989, setting forth a “definitive volume teaching the art of the subject.” (EX1019, *xix*.) Horowitz is prior art to the ’568 patent under at least 35 U.S.C. §§102(a) and (b).

39. Relevant to this proceeding, Horowitz includes, in a chapter titled “Foundations,” disclosure of diodes and rectifiers for use in power supply circuits. (EX1019, 43-53.) Horowitz provides numerous examples of rectifiers, as well as specific instructions, including schematics, part number listings, and instrumentation diagrams, for implementing rectifiers into practical systems. (EX1019, 43-53.)

40. Horowitz is analogous art to the claimed invention at least because it is a comprehensive textbook in the same field of endeavor (electronic circuits) as the ’568 patent, setting forth a “definitive volume teaching the art of the subject”; and provides disclosures analogous to those of the ’568 patent. (EX1010, *xix*.) For

example, Horowitz includes specific chapters and passages relating to power supply circuits, batteries, and electronic components such as rectifier circuits—analogous to the ’568 patent’s disclosure of an inductive battery charging system that utilizes a rectifier to deliver induced electric current to the battery. (*See, e.g.*, EX1019, 44-55; EX1001, 1:19-63, Abstract.) Horowitz provides specific guidance for implementing such components, and is thus reasonably pertinent to the problem of battery charger design faced by the inventor of the ’568 patent. (*Id.*)

4. Claim 1

41. Claim 1 is rendered obvious based on Baarman-878 in view of the NCP1800 Datasheet and Horowitz.

a. [Preamble] ***A contact-less chargeable battery including a charging circuit for charging an electric energy to a battery cell, the contact-less chargeable battery comprising:***

42. The preamble is met based on Baarman-878. For example, Baarman-878 describes “contactless energy transmission systems (CEETS),” which “are composed of power supplies and remote devices.” (EX1007, 1:33-51.) The remote device can include a chargeable battery that is charged inductively by the power supply. (EX1007, 1:47-51.)

b. **[A]** ***a high frequency AC current inducing unit that includes a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil of an external contact-less charging device;***

43. This element is met based on Baarman-878. For example, Baarman-878's battery charging systems use magnetic induction to wirelessly transfer energy from a primary winding (coil) in the power supply to a secondary winding in the battery. (EX1007, 1:33-51.)

44. Baarman-878 discloses contactless power supply (CPS) 305 (an external contact-less charging device), which becomes inductively coupled to a chargeable remote device 306 when in the presence of the remote device:

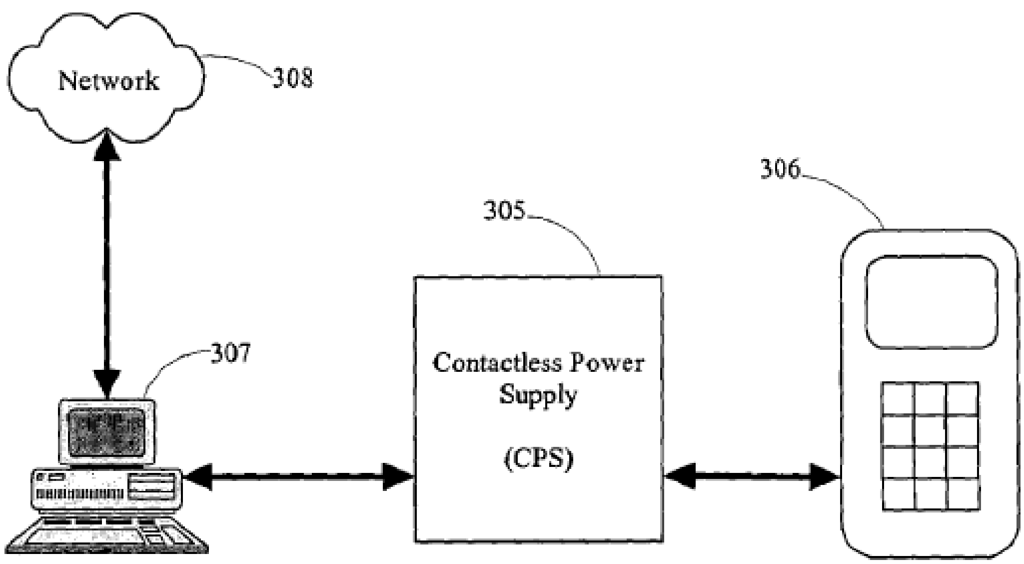


FIG. 6

(EX1007, 7:22-25, Fig. 6.)

45. Contactless power supply 305 includes a power source 310, which supplies AC power to primary winding 334 (of tank circuit 314) via inverter 312:

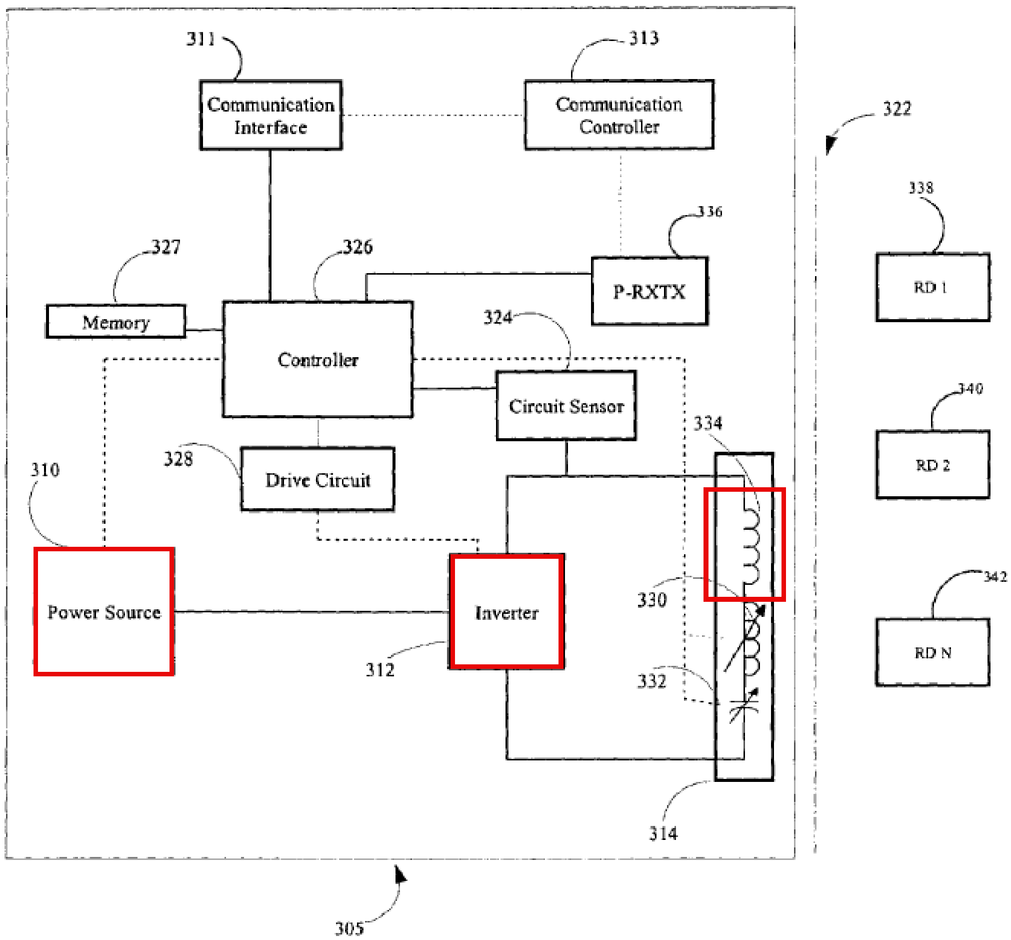


Fig. 7

(EX1007, 7:46-52, 8:41-46, Fig. 7 (annotated).)

46. Baarman-878 discloses the tank circuit 314 is "inductively coupled to secondary winding 316" of the remote device 338, via an air gap[1]:

[1] The POSITA would understand Baarman-878's reference to "dashed line 320" of Fig. 7, which "indicates an air gap," to be a clerical error intended to refer to element 322 shown in Fig. 7. This is at least because there are no other dashed lines in Fig. 7 indicated with a numeral; because there are no references in the specification to element 322; and because Fig. 7 depicts element 322 as an air gap.

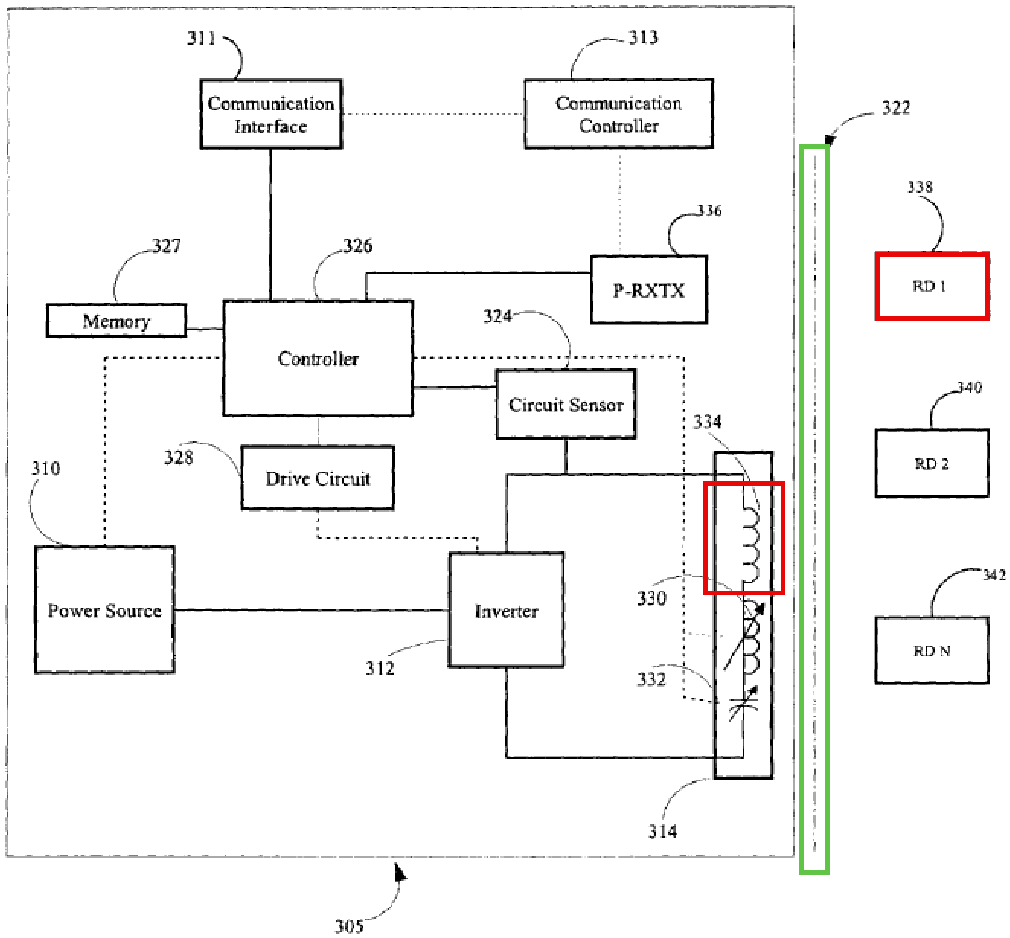


Fig. 7

(EX1007, 7:46-55, Fig. 7 (annotated).)

47. The POSITA would understand supplying the AC power to the primary winding, as described in Baarman-878, to generate a magnetic field by the operation of the Biot-Savart Law. (*See* EX1016, 112-113; EX1017, 589-601.) This is consistent with Baarman-878's disclosure of applying a signal to primary winding 14 "for generating a magnetic field." (EX1007, 3:66-4:12.) Further, Baarman-878 discloses that "[e]nergy from a primary winding in the power supply

is transferred inductively to a secondary winding in the chargeable device." (EX1007, 1:51-53.) The POSITA would understand from this, and the operation of Faraday's Law, that applying AC current to the primary winding 334 will generate a magnetic field to induce an AC current in secondary winding 316. (*See* EX1016, 112-113; EX1017, 780-89.) The POSITA would understand Baarman-878's secondary winding 316 to correspond to variable secondary winding 353 in Fig. 8. Secondary winding 353 induces the AC current, as described above; and provides power to load 350, which may be a rechargeable battery (thus referred to herein as battery 350):

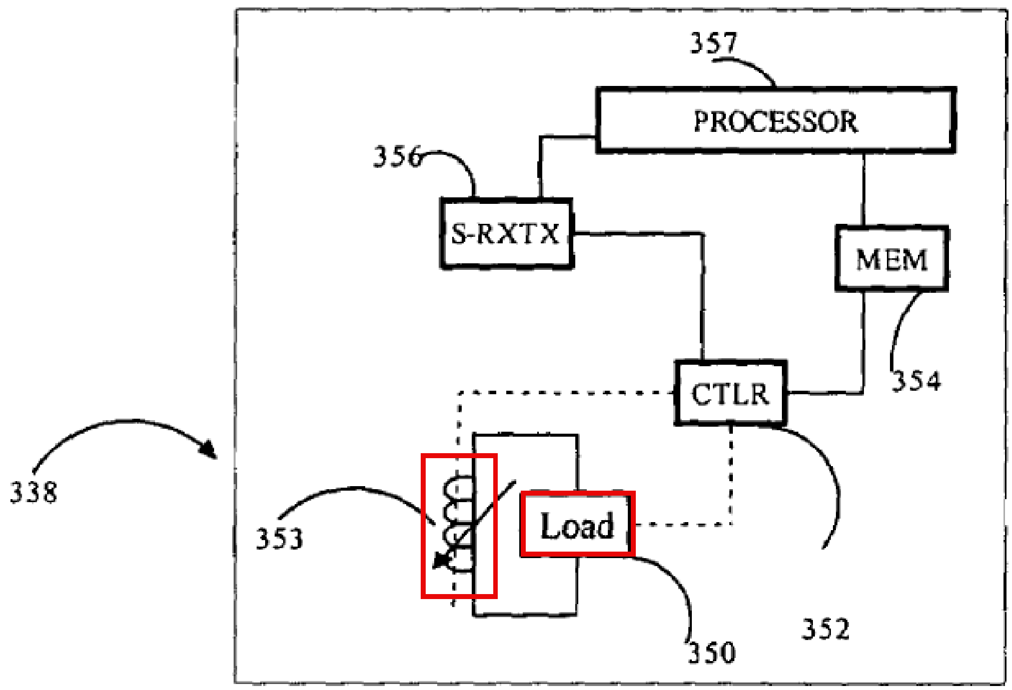


FIG. 8

(EX1007, 9:7-11, Fig. 8 (annotated).)

48. The induced AC current meets the claimed "high frequency" AC current. The '568 patent does not define "high frequency," stating only that a high frequency AC current may be "several tens KHz." (EX1001, 6:15-18.) Baarman-878 discloses, via a patent application incorporated by reference, that the tank circuit (and thus the induced AC current) can operate near 100 KHz, which is on the order of (and higher than) the "high frequency AC current" in the '568 patent. (EX1011, 28; EX1007, 3:58-63.) Baarman-878 further describes the frequency as

variable, and indicates that the secondary winding 353 is coreless and thus can "operate over a wider range of frequencies," which the POSITA would understand to include the claimed high frequency current. (EX1007, 9:12-16.)

c. [B] *a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;*

49. This element is met based on Baarman-878 in view of Horowitz. While Baarman-878 describes that its remote device includes a secondary winding 353 that provides induced AC current to a rechargeable battery 350, as described above, Baarman-878 does not detail how the AC current is applied to battery 350 to recharge it. However, the POSITA would understand that an AC signal, such as the AC current induced in the secondary winding 353, is converted to a DC signal (rectified) in order to charge a battery, such as battery 350 in Baarman-878. (*See, e.g.*, EX1013, 1:19-21.) The POSITA would thus be motivated to look to the prior art for a solution to how to perform this conversion.

50. Horowitz provides such a solution. Horowitz discloses that "a rectifier changes ac to dc," and provides multiple examples of rectifiers (*e.g.*, bridge rectifiers) that can be used in power supplies such as Baarman-878. (EX1019, 46-47, Fig. 1.74.) For example, Horowitz discloses that a DC power supply that uses a bridge rectifier to convert an AC input from a secondary coil to a DC output is shown in Figure 1.74:

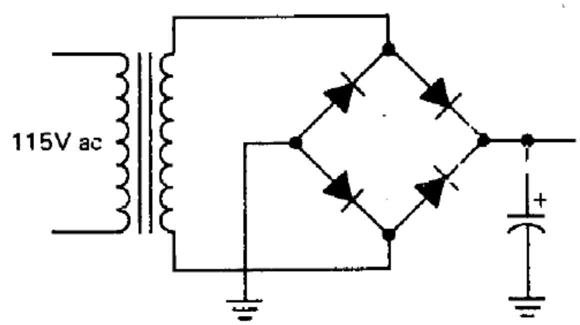


Figure 1.74. Bridge rectifier circuit. The polarity marking and curved electrode indicate a polarized capacitor, which must not be allowed to charge with the opposite polarity.

(EX1019, 46-47, Fig. 1.74.)

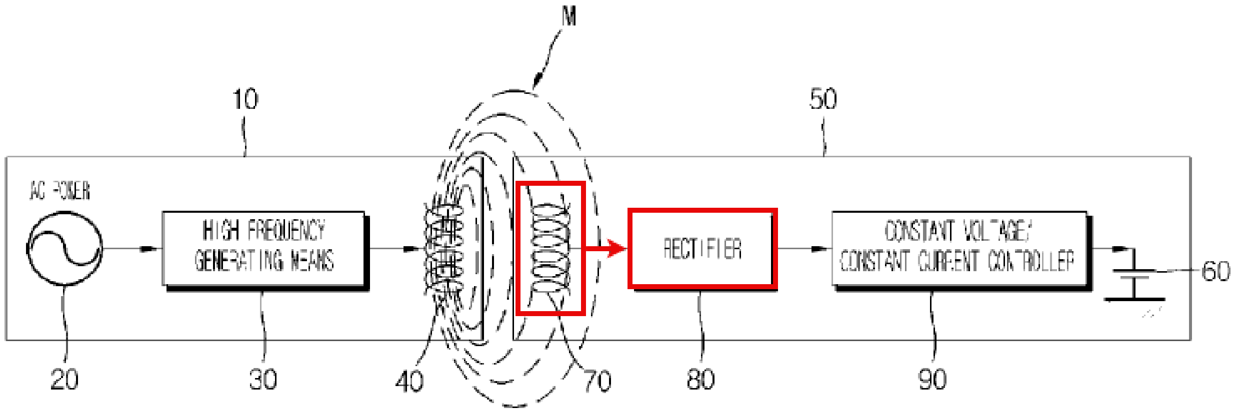
51. Accordingly, the POSITA would have been motivated to combine the rectifier in Horowitz with Baarman-878 to serve the rectifier's intended function: converting the high frequency AC current induced in Baarman-878's secondary winding 353 into a DC current, to apply to battery 350.

52. The POSITA would have had a reasonable expectation of success in doing so. Rectifiers are established and well-understood circuits that utilize known components, such as diodes, to convert AC signals to DC signals. (*See, e.g.*, EX1016, 131-135.) For example, Horowitz explains that converting AC to DC is "one of the simplest and most important applications of diodes ([which] are sometimes called rectifiers)." (EX1019, 44.) Further, Horowitz's Figure 1.74 illustrates a circuit analogous to Baarman-878: the rectifier is installed in a DC power supply, analogous to Baarman-878's DC power supply that charges battery 350; and the rectifier receives a 115V AC signal from secondary coil 70, analogous

to Baarman-878's secondary winding 70. (EX1007, 2:5-12 (emphasis added), Fig. 1.) Horowitz further discloses that rectifiers such as shown in Figure 1.74 are easily obtained as prepackaged modules, with a wide array of options to choose from. (EX1019, 46-47.) The combination of Baarman-878 and Horowitz thus combines prior art elements according to known methods to yield predictable results.

53. Further, Horowitz's teaching of the rectifier is consistent with the disclosures of the '568 patent. For example, the '568 patent describes a "conventional" contact-less charging method that is "currently widely utilized". (EX1007, 1:57-65, 2:21-32, 2:49-53, Fig. 1.) According to this known method, a battery charger includes "a rectifier 80 for converting the high frequency AC current induced in the secondary coil 70 into a DC current"—analogous to the Figure 1.74 rectifier of Horowitz and its use in a DC power supply circuit, as shown in Fig. 1 of the '568 patent:

[Fig. 1]



(EX1007, 2:5-12, Fig. 1 (annotated).)

d. [C] ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and***

54. This element is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz. Baarman-878 teaches that remote device 338 includes a remote device controller 352 that controls the battery 350:

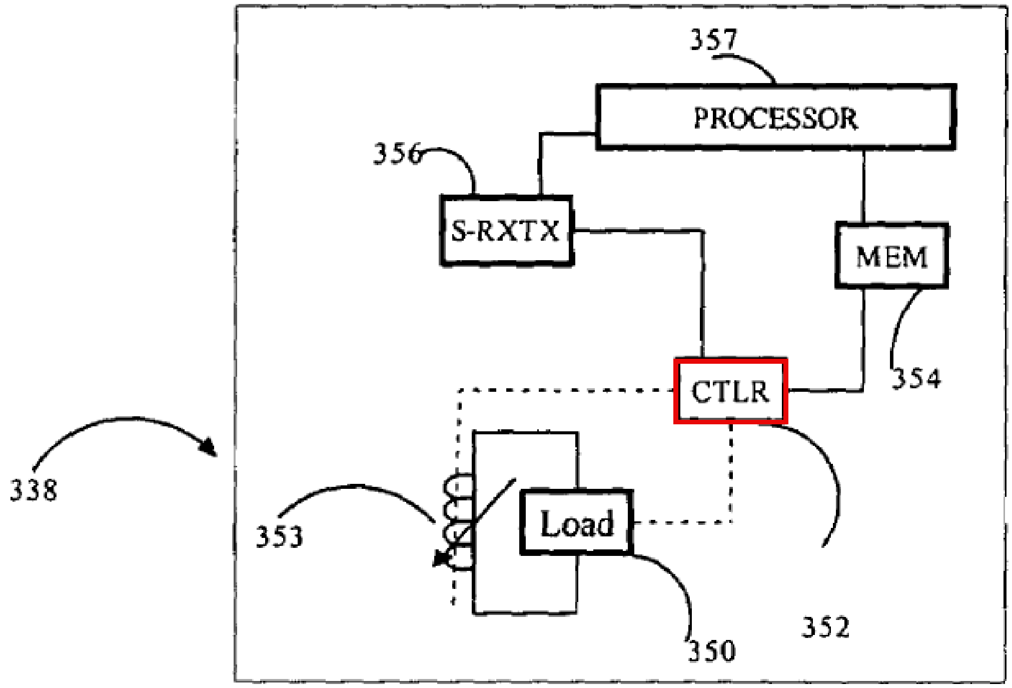


FIG. 8

(EX1007, 9:17-29, Fig. 8 (annotated).)

55. The POSITA would have understood that controllers such as controller 352 can be used to manage the charging of the battery, including by regulating voltage and current levels, and by providing functions such as overvoltage protection. (*See, e.g.*, EX1013, 1:22-25.) Similarly, Baarman-878 discloses that controller 352 can turn the battery on and off, and can control functions of the inductive power supply that charges the battery. (EX1007, 9:17-29.) Further, in Fig. 8, Baarman-878 shows the controller 352 connected (via

dotted lines) to the secondary coil 353 and to the battery 350, indicating that the controller 352 may communicate with those components. (EX1007, Fig. 8.)

(i) Constant voltage/constant current supplier receiving the DC current from the rectifier

56. Baarman-878 does not detail specifically how controller 352 controls the charging of battery 350. However, the POSITA would have understood that some rechargeable batteries, including lithium-ion batteries, must be charged according to a constant current/constant voltage process, so that the battery can be charged fully, repeatedly, and safely. (*See* EX1013, 1:36-55.) Accordingly, in implementing controller 352, the POSITA would have been motivated to look to the teachings of battery charge controllers that supply constant current/constant voltage to the battery.

57. The POSITA would have looked to the NCP1800 Datasheet, which describes the NCP1800—a "constant current, constant voltage (CCCV) lithium ion battery charge controller" for charging batteries in devices such as cellular phones. (EX1012.) The NCP1800 Datasheet teaches that, in a "typical application," a CCCV controller receives a DC input signal (V_{IN}), and provides an output signal to charge a battery:

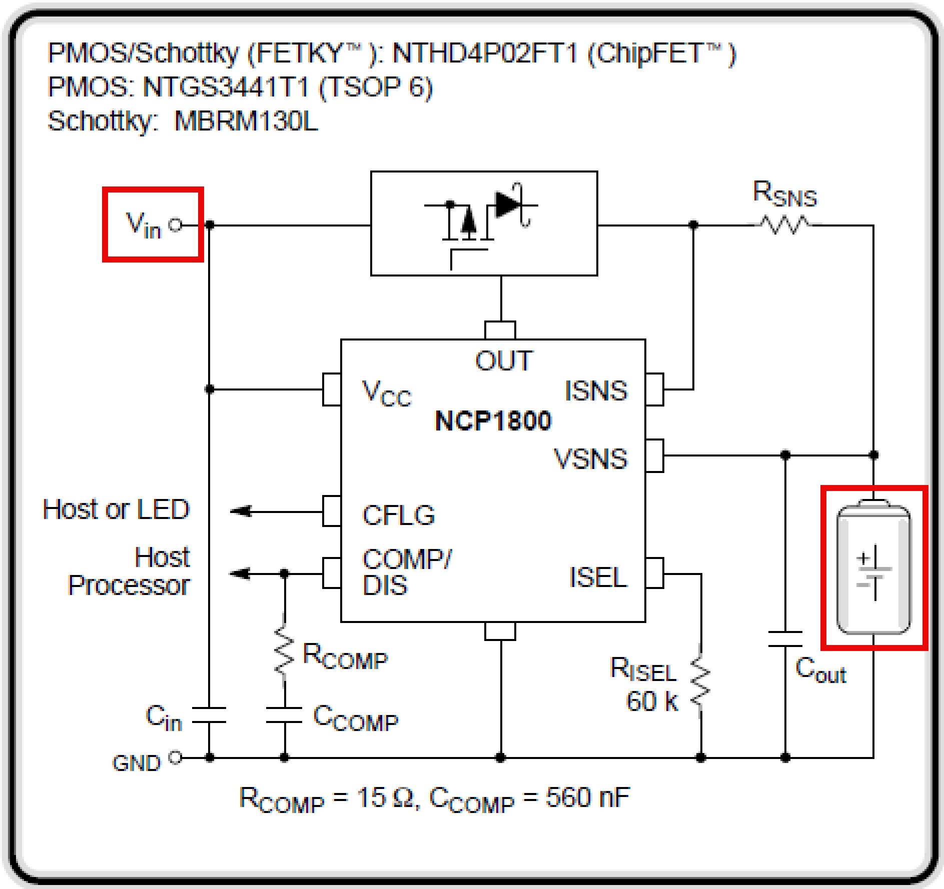


Figure 1. Typical Application

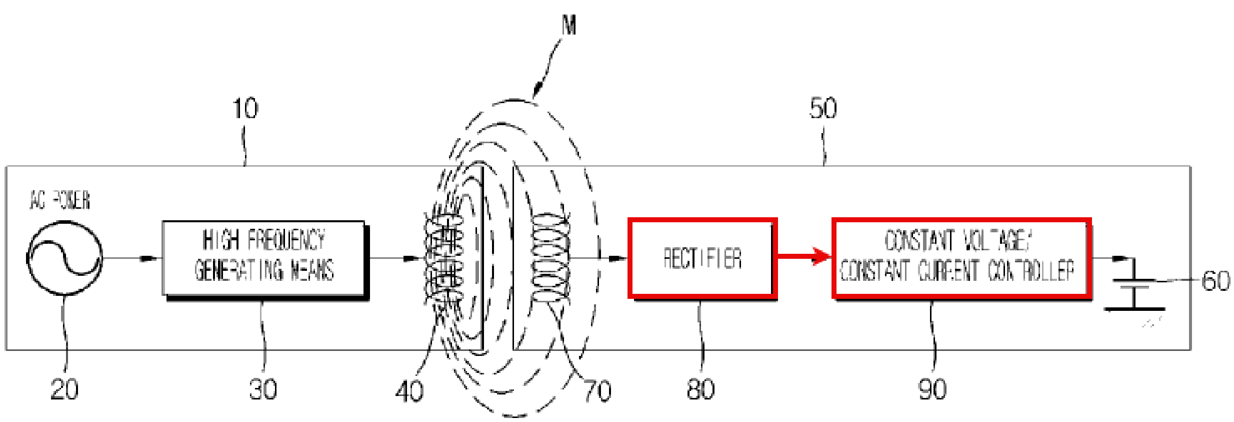
(EX1012, 1, 2, Fig. 1 (annotated).)

58. The POSITA would have applied the teachings of the NCP1800 Datasheet to implement controller 352 of Baarman-878. To do so, the POSITA would have applied the output of the rectifier of Horowitz, as described above, to the input of the controller 352. This is because in Baarman-878, an AC current is induced in secondary coil 353; but a CCCV controller (such as disclosed in the NCP1800 Datasheet) accepts a DC signal as input (*e.g.*, V_{IN}). (EX1012, 1, 2, Fig. 1 (annotated).) The POSITA thus would have appreciated the need to convert the AC signal from Baarman-878's secondary coil 353 to a DC signal for input to the

controller; and would have understood Horowitz to teach a rectifier circuit to achieve this goal. The POSITA would have been motivated to make the combination, and would have had a reasonable expectation of success in doing so, for the reasons described above and for Element [B].

59. This combination is consistent with the disclosures of the '568 patent. For example, the '568 patent discloses that in a conventional contactless charging method, constant current/constant voltage supply 90 was a "well-known" and "widely used" circuit element for charging a battery. (EX1001, 2:5-20, Fig. 1.) Fig. 1 illustrates the conventional method, in which constant current/constant voltage supply 90 receives a DC signal from rectifier 80, and provides power to battery cell 60:

[Fig. 1]



(EX1001, 1:64-65, Fig. 1 (annotated).)

(ii) Supplying a charging power to the battery cell in a constant voltage/constant current mode

60. The NCP1800 Datasheet further teaches providing a charging power to a battery cell via a constant current/constant voltage charging process. (EX1012, 7-10.) For example, the NCP1800 Datasheet teaches providing charging power in a "full charge (current regulation)" phase once the battery voltage reaches a first threshold level (V_{PCTH}). (EX1012, 10.) This is a constant current charging mode in which the charging current is maintained at a constant level (I_{REG}):

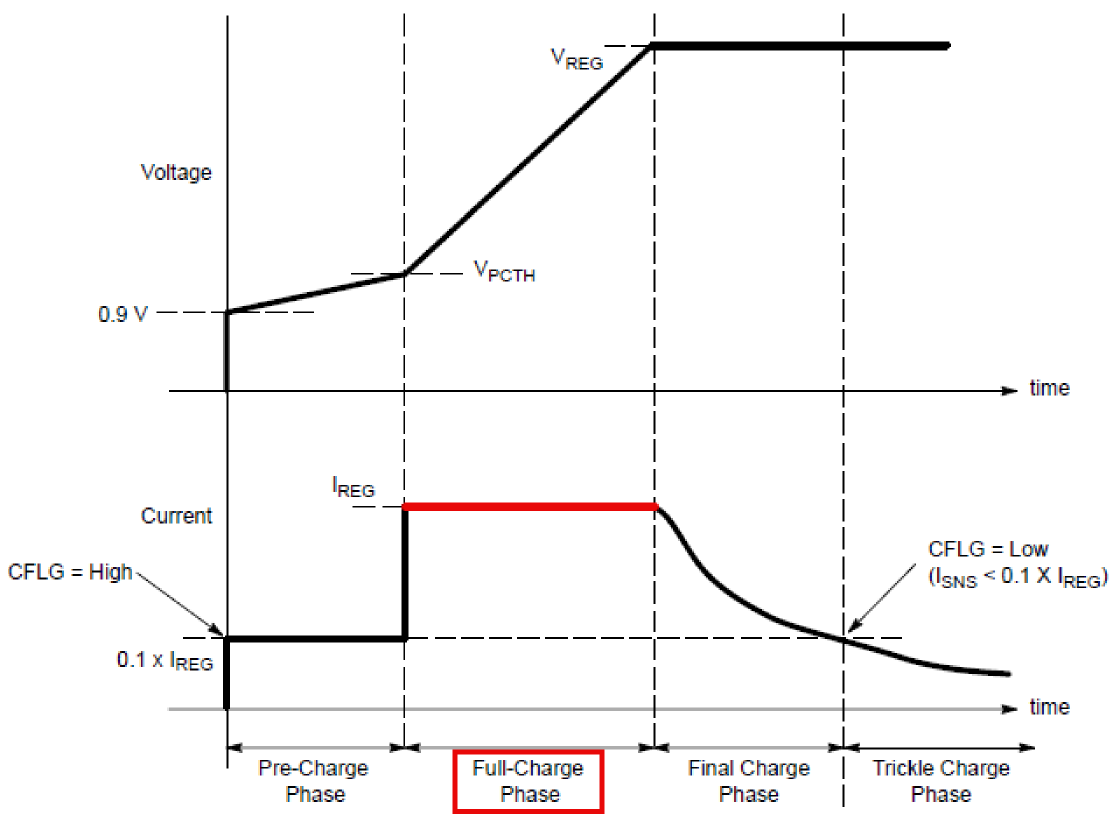


Figure 16. Typical Charging Algorithm

(EX1012, 8-10, Fig. 16 (annotated).)

61. Once the battery voltage reaches a second threshold level (V_{REG}), charging power is then provided in a "final charge (voltage regulation)" phase. This is a constant voltage charging mode in which the voltage V_{REG} is maintained, and the charging current decreases based on the state of the battery:

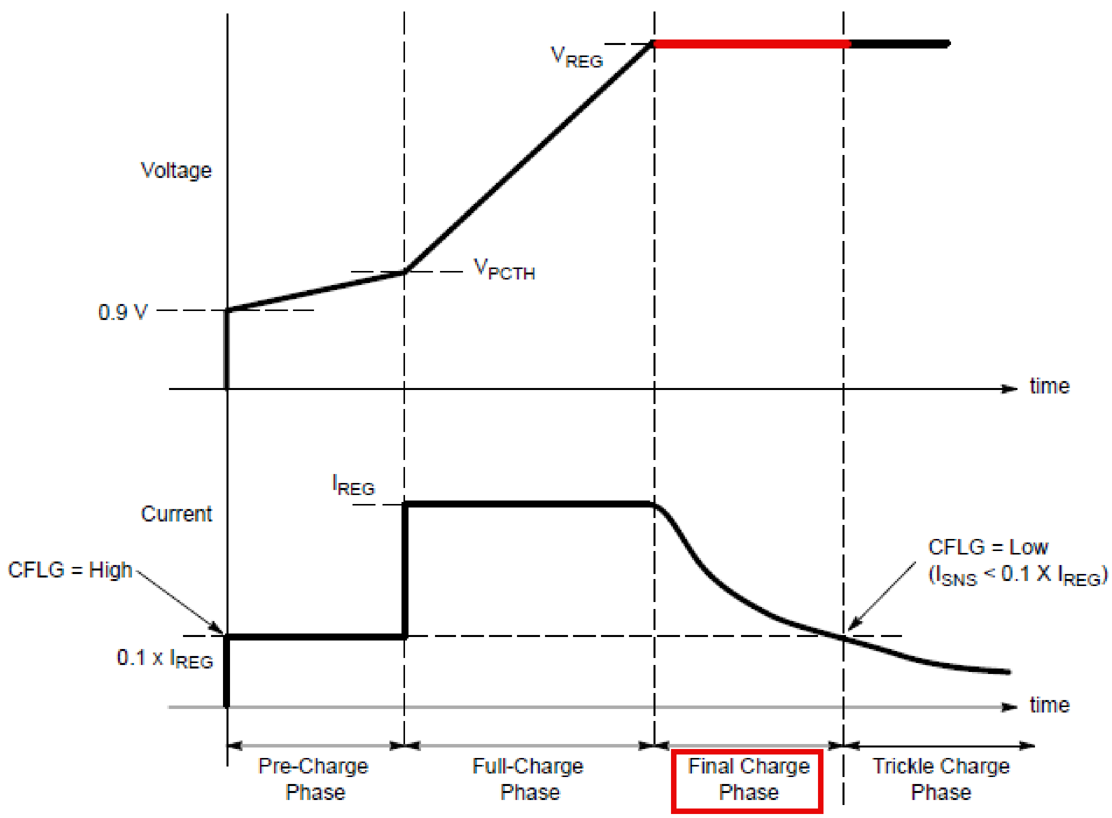


Figure 16. Typical Charging Algorithm

(EX1012, 8-10, Fig. 16 (annotated).)

62. The POSITA, motivated as described above, would have applied the teachings of the NCP1800 Datasheet to Baarman-878 and the Horowitz rectifier to meet the claim limitation. Specifically, the POSITA would have implemented

Baarman-878's controller 352 according to the NCP1800 Datasheet's teachings of a battery controller (*i.e.*, controller 352) receiving a DC input voltage (*i.e.*, from the rectifier as described above); and providing charging power to a battery (*i.e.*, battery 350) in accordance with a constant current/constant voltage mode.

63. The POSITA would have enjoyed a reasonable expectation of success in making the combination. First, as the '568 patent admits, CCCV supplies were "well-known circuit element[s]" that were "widely used" in battery charging devices such as Baarman-878. (EX1001, 2:13-15; *see also* EX1013, 1:13-61.) Similarly, the '568 patent admits that in the prior art, it was known to configure a CCCV supply to receive DC current from a rectifier (*e.g.*, rectifier 80), and apply an output signal to a battery cell. (EX1001, 2:13-20, Fig. 1.) Thus, the application of the NCP1800 Datasheet (which describes an analogous CCCV supply) to Baarman-878 merely involves the application of known techniques. Second, Baarman-878 discloses that its controller 352 can include a "any one of a multitude of commonly available microcontrollers," such as the Intel 8051 or Motorola 6811; RAM; ROM; and analog and digital outputs. (EX1007, 9:21-29.) The POSITA would understand that these components of Baarman-878 to be analogous to components disclosed in the NCP1800 Datasheet as implementing a CCCV supply (*e.g.*, "Control" and "Logic" units; analog output voltages). Third, the NCP1800 Datasheet is expressly intended for battery charging circuits, such as Baarman-878;

and provides detailed instruction for implementing its teachings, including schematics, electrical characteristics, flowcharts, and guidelines for selecting external components. (EX1012, 1-13.)

e. [D] ***an overvoltage monitoring unit that includes first and second voltage detectors respectively detecting first and second voltages at both ends of the constant voltage/constant current supplier and a microprocessor monitoring the detected voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field,***

64. This element is met based on Baarman-878 in view of NCP1800 Datasheet. For example, the claimed overvoltage monitoring unit is met by at least by controller 352, implementing a CCCV supply as taught by the NCP1800 Datasheet, in the combination as described above for element [C].

(i) First and second voltage detectors

65. The NCP1800 Datasheet teaches first and second voltage detectors that respectively detect first and second voltages at both ends of the CCCV supply. For instance, as shown below, input signal V_{CC} is a first voltage at a first (front) end of the CCCV supply (*e.g.*, a NCP1800 unit), and output signal V_{SNS} is a second voltage at a second (rear) end of the CCCV supply:

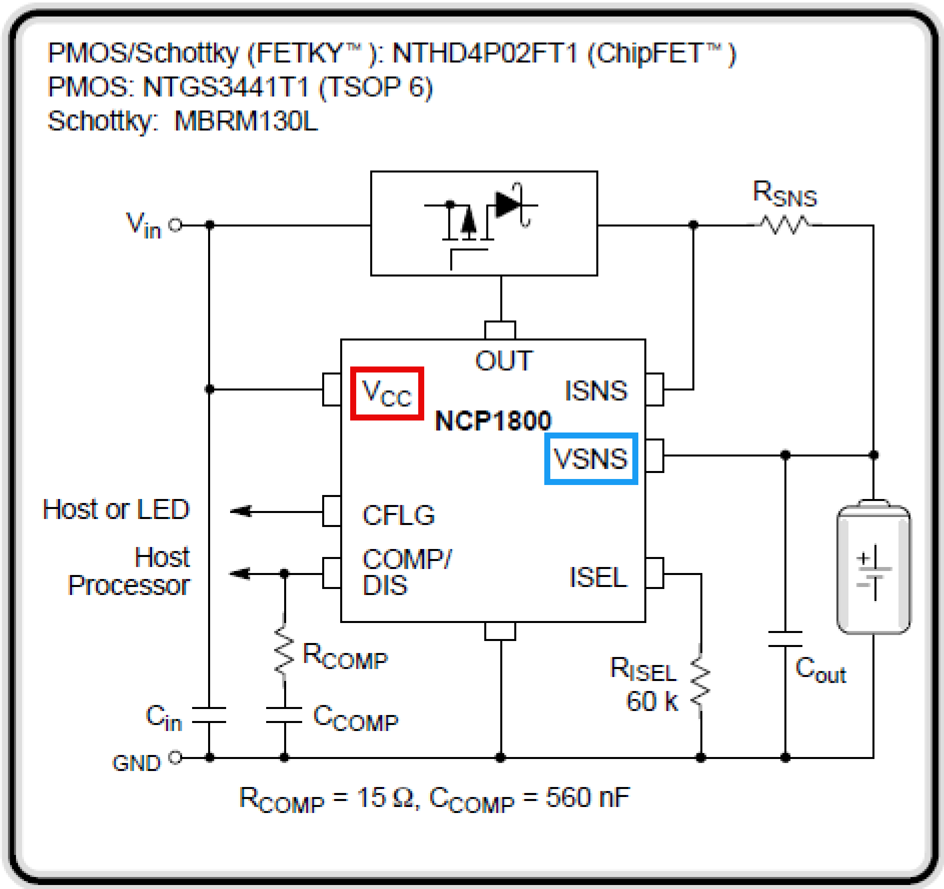


Figure 1. Typical Application

(EX1012, 1, 2, Fig. 1 (annotated).)

66. In an internal block diagram, Fig. 2, the NCP1800 Datasheet illustrates example first detectors (annotated in red below) that detect the first voltage V_{CC}, and second detectors (blue) that detect the second voltage V_{SNS}:

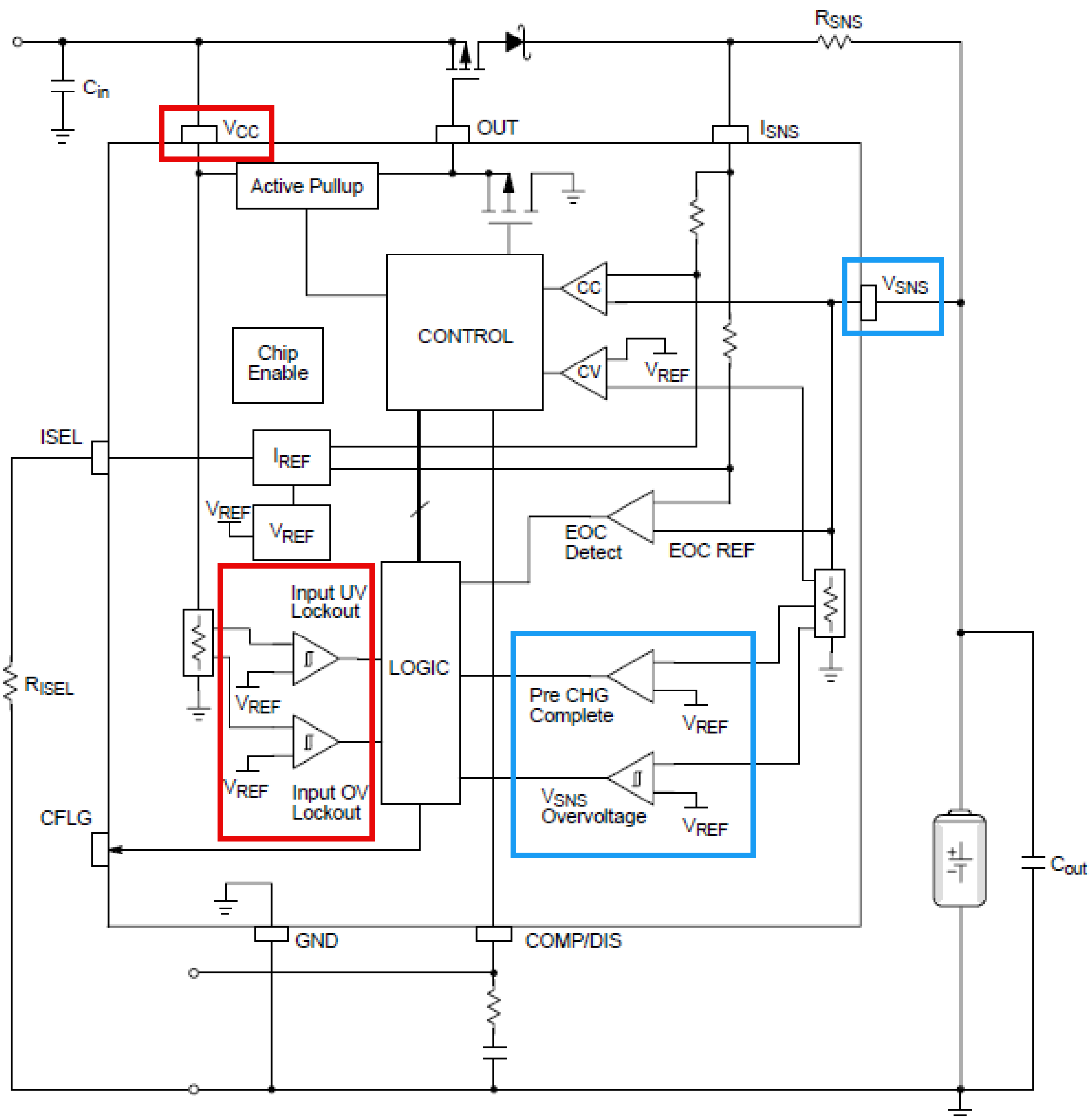


Figure 2. NCP1800 Internal Block Diagram

(EX1012, 1-4, Fig. 2 (annotated).)

67. The NCP1800 Datasheet discloses an "Input Over and Under Voltage Lockout" feature. (EX1012, 1.) For example, as illustrated, V_{CC} is detected and monitored by a logic circuit to determine overvoltage (OV) or undervoltage (UV) conditions; and V_{SNS} is detected and monitored by the logic circuit to determine

overvoltage conditions, or whether a pre-charging state has been completed. (EX1012, 1-4, 8, Fig. 2.)

(ii) Microprocessor monitoring the detected voltages

68. In the combination of Baarman-878 and the NCP1800 Datasheet, controller 352 implements teachings of the logic circuit disclosed in the NCP1800 Datasheet as monitoring the detected voltages. Controller 352 meets the claimed microprocessor at least because Baarman-878 discloses that controller 352 can include a microcontroller, such as an Intel 8051 or Motorola 6811, which the POSITA would understand to include a microprocessor. (EX1007, 9:21-25; *see* EX1016, 347-48.) Moreover, the POSITA would have utilized the microcontroller to implement teachings of the "Logic" circuit of the NCP1800 Datasheet. (*See* EX1016, 347-48 (microcontrollers "can replace entire logic circuits" and are "significantly easier to program and are easier to interface with other circuits and devices").)

69. As the NCP1800 Datasheet teaches, monitoring the detected voltages includes one or more of a determination that the first voltage (V_{CC}) exceeds a maximum voltage (V_{OVLO}); a determination that V_{CC} is below a minimum voltage (V_{UVLO}); a determination that the second voltage (V_{SNS}) exceeds a maximum voltage (V_{SOVLO}); and a determination that V_{SNS} has reached a pre-charging voltage (V_{PCTH}). (EX1012, 1-4, 7-10, Figs. 2, 14, 15.) The NCP1800 Datasheet discloses

that these determinations are used to control the battery charging "precisely and safely." (EX1012, 10.) For example, the determinations are used to transition between various charging modes and fault modes, as illustrated in Fig. 14:

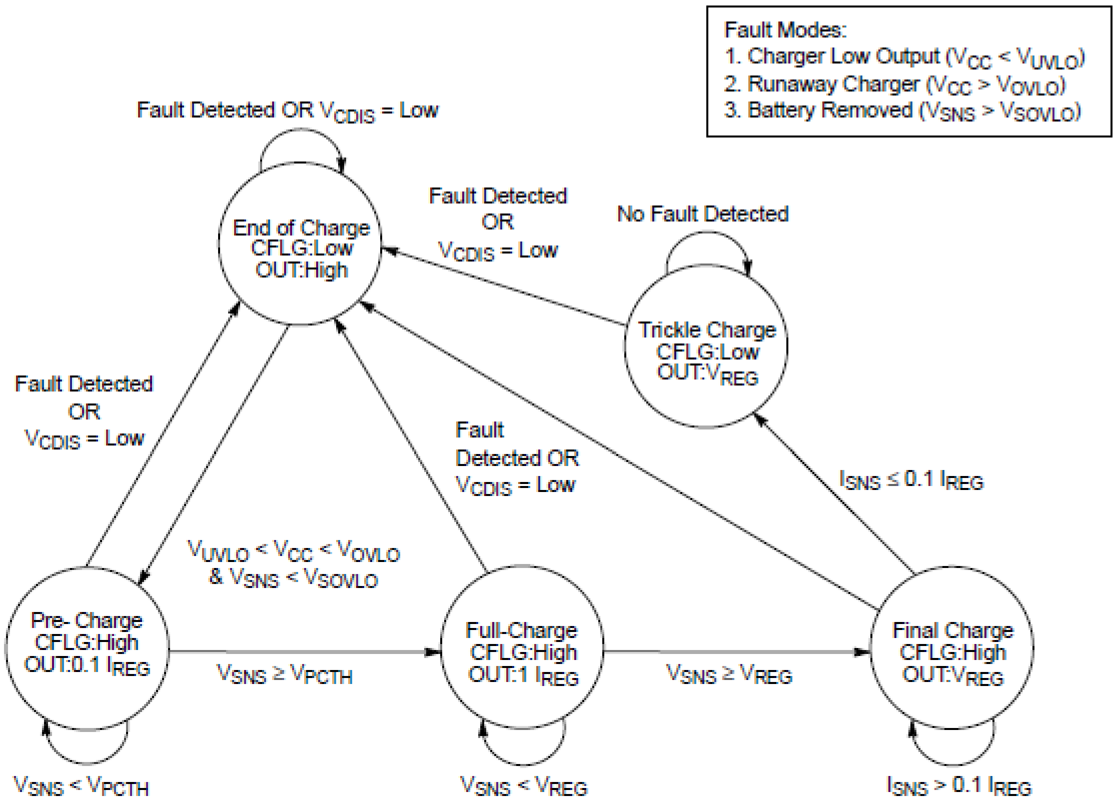


Figure 14. NCP1800 State Machine Diagram

(EX1012, Fig. 14.)

70. The NCP Datasheet also discloses disconnecting the power supply input if V_{CC} is determined to exceed the maximum voltage. (EX1012, 10.)

(iii) Transmitting a monitoring result to the charging device

71. Controller 352 wirelessly communicates with the power supply 305 via remote transceiver (S-RXTX) 356:

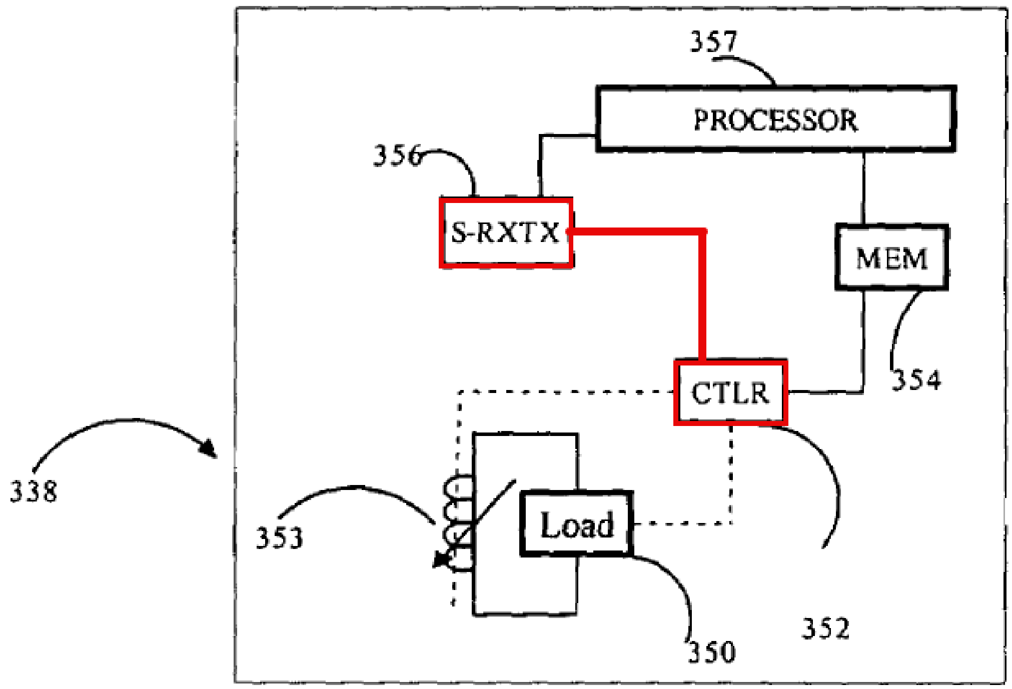


FIG. 8

(EX1007, 9:36-38, Fig. 8 (annotated).)

72. Remote transceiver 356 uses Wi-Fi, infrared, Bluetooth, or cellular communications to wirelessly transmit signals to the power supply's transceiver 336. (EX1007, 9:36-40, Fig. 8.) The two transceivers can also communicate wirelessly via the primary or secondary windings, or via power line communication systems. (EX1007, 9:41-44.) Power supply transceiver (P-RXTX)

336, in turn, provides signals received from the remote device 338 to the power supply controller 326:

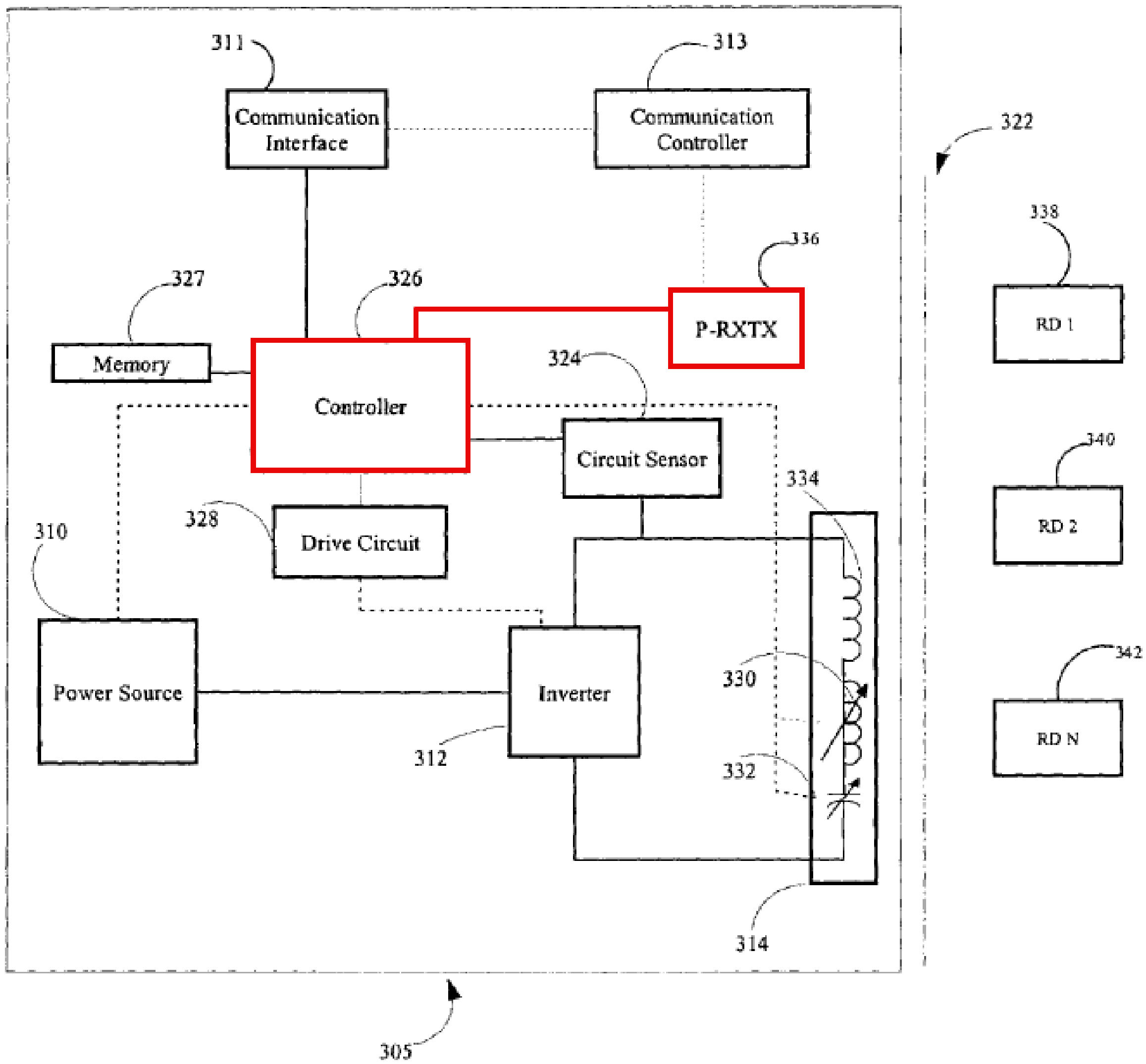


Fig. 7

(EX1007, 8:47-51, Fig. 7 (annotated).)

73. Baarman-878 teaches that in remote device 338, controller 352 controls the operation of battery 350 by "controlling the various functions within

the adaptive inductive power supply," *i.e.*, by communicating control signals to the power supply controller 326. (EX1007, 9:17-29, Fig. 8.) The received signals can be used by power supply controller 326 to induce a change in intensity of the magnetic field generated at the primary winding 334. (EX1007, 8:8-12, 10:4-64, Fig. 9; For example, controller 326 can manipulate the rail voltage of the power source 310, thereby changing the amplitude of the inverter 312. (EX1007, 8:8-12.) As described above for element [A], inverter 312 supplies AC power to tank circuit 314. (EX1007, 7:46-51.) The POSITA would thus understand that changing the inverter amplitude will accordingly change the amplitude of the AC power; and thus the intensity of the magnetic field generated at the tank circuit's primary winding 334 by the Biot-Savart Law and Faraday's Law. (EX1007, 7:46-51, 8:41-46; EX1017, 589-601, 780-89.)

74. To the extent not expressly disclosed in Baarman-878 or the NCP1800 Datasheet, it would have been obvious for the controller 352 to use remote transceiver 356 to transmit to the power supply a result of the monitoring described above for element [C]. Baarman-878 does not detail the exact nature of the control signals transmitted to the power supply; the POSITA would thus have been motivated to look to prior art references, such as the NCP1800 Datasheet, to supply this information. As the NCP1800 Datasheet explains, the first and second voltages (V_{CC} and V_{SNS}) are monitored to control battery charging "precisely and

safely," such as by protecting the circuit from overvoltage conditions. (EX1012, 10.) And controller 352 wirelessly transmits signals to control the power supply, in order to control the battery 350. (EX1007, 9:17-29, Fig. 8.) The POSITA would thus have utilized controller 352 to transmit a monitoring result—*e.g.*, an instruction to lower the rail voltage, thus reducing the AC current provided to the primary winding (and thus induced in the secondary winding), based on a determination that V_{CC} is too high—to the power supply, in order to control the battery precisely (*e.g.*, within defined input voltage parameters) and safely (*e.g.*, avoiding overvoltage conditions).

f. [E] *wherein the monitoring result includes a wireless feedback control signal to induce the change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less chargeable battery and the external contact-less charging device.*

75. This element is met. As described above for element [D], the monitoring result includes a wireless feedback control signal transmitted via transceiver 356, which adjusts a power applied to the primary winding 334 and thus induces a change of intensity of the magnetic field.

76. Inducing the change of intensity is based on relative positions of the chargeable battery 350 and the external charging device 305. As described above, battery 350 belongs to remote device 338, which also includes secondary winding

353. And charging device 305 includes primary winding 334. The POSITA would understand that, in typical implementations, by Faraday's Law, as the remote device 338 and the charging device 305 become closer, and the air gap accordingly becomes smaller, the magnetic flux of the secondary winding 353 increases, and the induced current in the secondary winding becomes greater (and vice versa). (EX1017, 784-85.) Thus, bringing the remote device 338 toward the charging device 305 closer can increase the induced signal and result in an overvoltage condition (*e.g.*, the first voltage and/or second voltage exceeding a maximum voltage), prompting the monitoring result and power supply adjustment signal as described above. This sequence is analogous to the admitted "prior art" charging method described in the '568 patent. (EX1001, 2:21-32.)

(i) *Ex parte* Reexamination

77. In the prior art combination, inducing the change of intensity based on relative positions of the battery and the charging device is analogous to representations made by the '568 patent's owner to the USPTO during the *ex parte* reexamination. In that proceeding, the claims were rejected under 35 U.S.C. §112 for lack of specification support. (EX1003, 355-57.) To overcome the rejection, the patent owner directed the Examiner to the '568 specification disclosure (*e.g.*, EX1001 at 2:21-32), and argued as follows:

> That is, the chargeable battery provides an adjustment request signal based on an excessive charging power being transmitted to the

chargeable battery. This excessive charging power is generated based on the relative position of the secondary coil of the chargeable battery and the primary coil of the contact-less charging device. The contact-less charging device then adjusts the power applied to its primary coil based on the adjustment request signal, which is based on the relative positions of the chargeable battery and the contact-less charging device. ***Accordingly, the prior patent supports the claim language "adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less chargeable battery and the external contactless charging device."*** (EX1004B, 1224-28 (emphasis added).)

78. The patent owner's argument is analogous to the combination of Baarman-878 and the NCP1800 Datasheet. That is, in the combination, the chargeable battery (of remote device 338) provides an adjustment request signal (via transceiver 356) based on an excessive charging power (*e.g.*, V_{CC} or V_{SNS} exceeding an overvoltage limit). The excessive charging power is generated based on the relative position of the primary and secondary windings (*e.g.*, based on primary winding 334 of charging device 305 approaching secondary winding 353 of remote device 338). And the charging device 305 adjusts the power applied to primary winding 334 based on the adjustment request signal (*e.g.*, by reducing a rail voltage). (Notably, while these elements are found in the prior art, as demonstrated above, neither Baarman-878 nor the NCP1800 was before the Office during prosecution of the '568 patent, including the reexamination.)

5. Claim 5

79. Claim 5 is met by Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 1, wherein*

80. The preamble is met as described above for claim 1.

b. [A] *the monitoring result is a charging power adjustment request signal.*

81. This element is met as for claim 11[A] below.

6. Claim 7

82. Claim 7 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:*

83. The preamble is met at least by remote device 338 as described for claim 1.

b. [A] *a high frequency AC current inducing unit to which a high frequency AC current is induced by a magnetic field generated from an external contact-less charging device;*

84. This element is met as for claim 1[A].

c. [B] ***a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

85. This element is met as for claim 1[B].

d. [C] ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and***

86. This element is met as for claim 1[C].

e. [D] ***a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier and wirelessly transmitting a monitoring result to the external contact-less charging device so as to induce a change of intensity of the magnetic field,***

87. This element is met as for claim 1[D].

f. [E] ***wherein the change of intensity of the magnetic field is based on relative positions of the contact-less charging circuit module and the external contact-less charging device.***

88. This element is met as for claim 1[E].

7. Claim 8

89. Claim 8 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less charging circuit module according to claim 7, wherein***

90. The preamble is met as described above for claim 7.

b. **[A]** ***the high frequency AC current inducing unit is a coil to which a magnetic flux of the magnetic field generated from the external contact-less charging device is linked.***

91. This element is met as for claim 1[A]. Magnetic flux of the magnetic field generated from power supply 305 (primary winding 334) is inductively linked to secondary winding 353 by Faraday's Law. (*See* EX1017, 780-89.)

8. Claim 11

92. Claim 11 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging circuit module according to claim 7, wherein***

93. The preamble is met as described above for claim 7.

b. **[A]** ***the monitoring result is a charging power adjustment request signal.***

94. This element is met as for claim 1[D]. For example, controller 352 transmits a monitoring result to controller 326 to "control[] the various functions within the adaptive inductive power supply," *e.g.*, by requesting that controller 326 decrease the rail voltage of power source 310. (EX1007, 8:8-12, 9:17-29, 10:4-64, Figs. 8, 9;

9. Claim 13

95. Claim 13 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging device for transmitting a charging power by electromagnetic induction to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:***

96. The preamble is met as for claim 1. For example, charging device 305 meets the claimed charging device, and remote device 338 meets the claimed chargeable battery. The monitoring result is met as described for 1[D] and 1[E]; that is, voltages V_{CC} and V_{SNS} are monitored as taught by NCP1800 Datasheet, with the monitoring result transmitted wirelessly to Baarman-878's charging device as described for 1[D](iii).

b. **[A]** ***a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;***

97. This element is met as for claim 1[A]. For example, primary winding 334 receives an AC current and forms a magnetic field as described for 1[A].

c. **[B]** ***a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and***

98. This element is met by Baarman-878. For example, in Baarman-878, inverter 312 "acts as an AC power source supplying the AC power to tank circuit 314," which includes the primary winding 334. (EX1007, 7:46-52, 8:41-46.)

Inverter 312 and tank circuit 314 thus operate as a power driving unit to apply the high frequency AC current to the primary winding 334.

d. [C] ***a microprocessor wirelessly receiving the monitoring result from the contactless chargeable battery and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that the charging power transmitted to the contact-less chargeable battery is adjusted;***

99. This element is met as for claim 1[A] and [D]. At least the power supply controller 326 meets the claimed microprocessor; controller 326 wirelessly receives the monitoring result from the battery 350 (*i.e.*, via controller 352 of remote device 338), as described for claim 1[D][(iii). Power supply controller 326 controls the high frequency power driving unit (*i.e.*, inverter 312, tank circuit 314) as described for claim 1[D](iii).

e. [D] ***wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.***

100. This element is met as for claim 1[E].

10. Claim 14

101. Claim 14 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging device according to claim 13, wherein***

102. The preamble is met as described above for claim 13.

b. **[A]** ***the magnetic field generating unit is a coil to both sides of which a high frequency AC current is applied.***

103. This element is met as for claim 13[A]. Inverter 312 applies a high frequency AC current to both sides of primary winding 334:

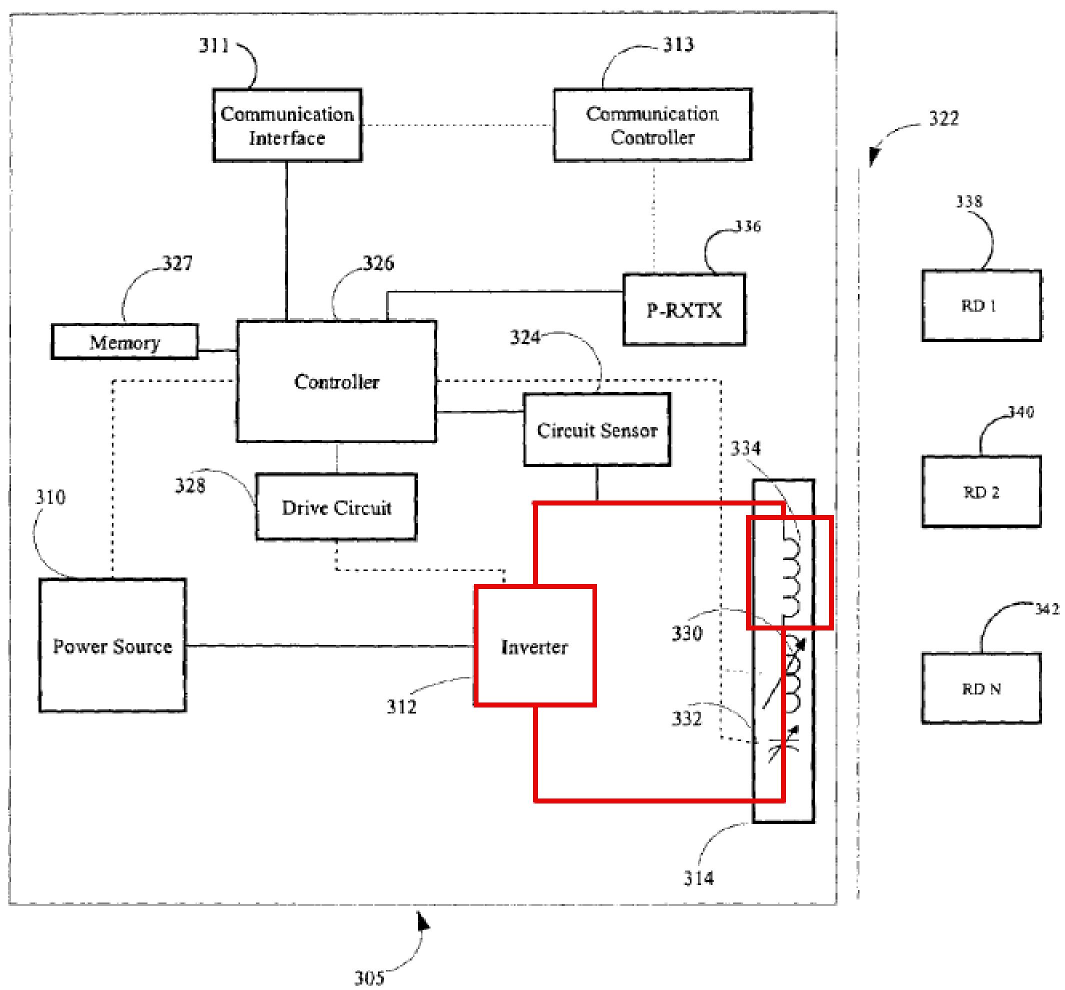


Fig. 7

(EX1007, 7:46-52, Fig. 7 (annotated).)

11. Claim 15

104. Claim 15 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging device according to claim 13, further comprising:*

105. The preamble is met as described above for claim 13.

b. [A] *an antenna coupled to the microprocessor and used to receive the monitoring result.*

106. This element is met as for claim 13[C]. Controller 326 receives the monitoring result via wireless transceiver 336; the POSITA would understand the result to be received via an antenna as for Ground 2, claim 3[A]. (EX1007, 8:47-52, Fig. 7.)

12. Claim 16

107. Claim 16 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging device according to claim 15, further comprising*

108. The preamble is met as described above for claim 15.

b. **[A]** ***a power supply receiving a common AC current, converting the common AC current into a DC current, and then supplying a constant-voltage current to the high frequency power driving unit,***

109. This element is met based on Baarman-878. For example, in Baarman-878, power source 310 provides DC current to inverter 312:

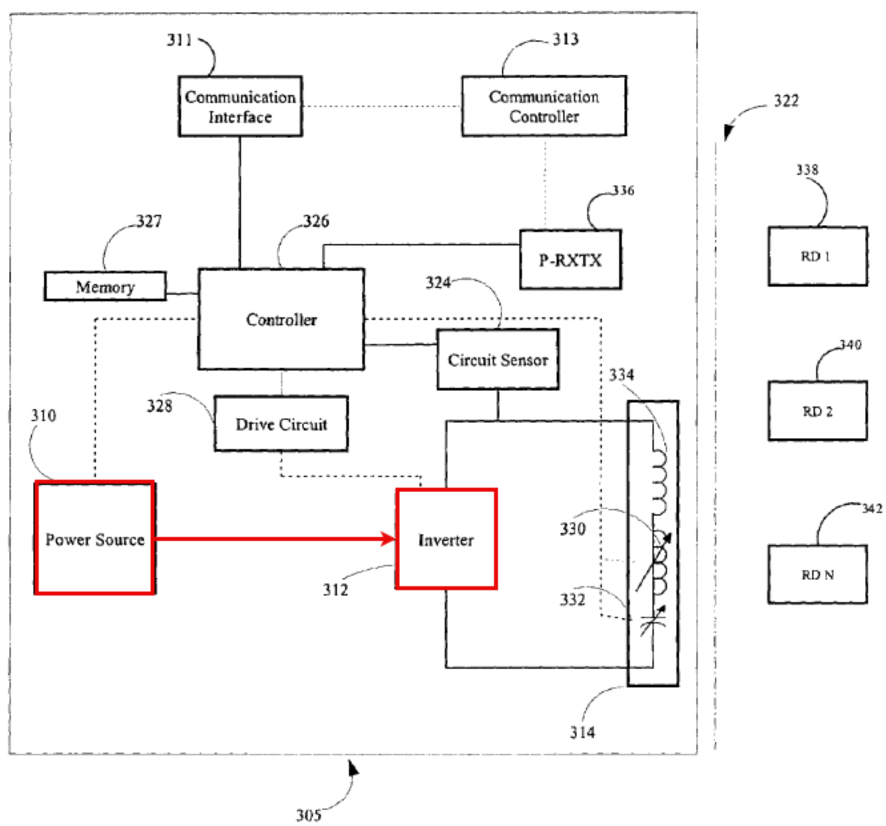


Fig. 7

(EX1007, 7:46-50, Fig. 7 (annotated).)

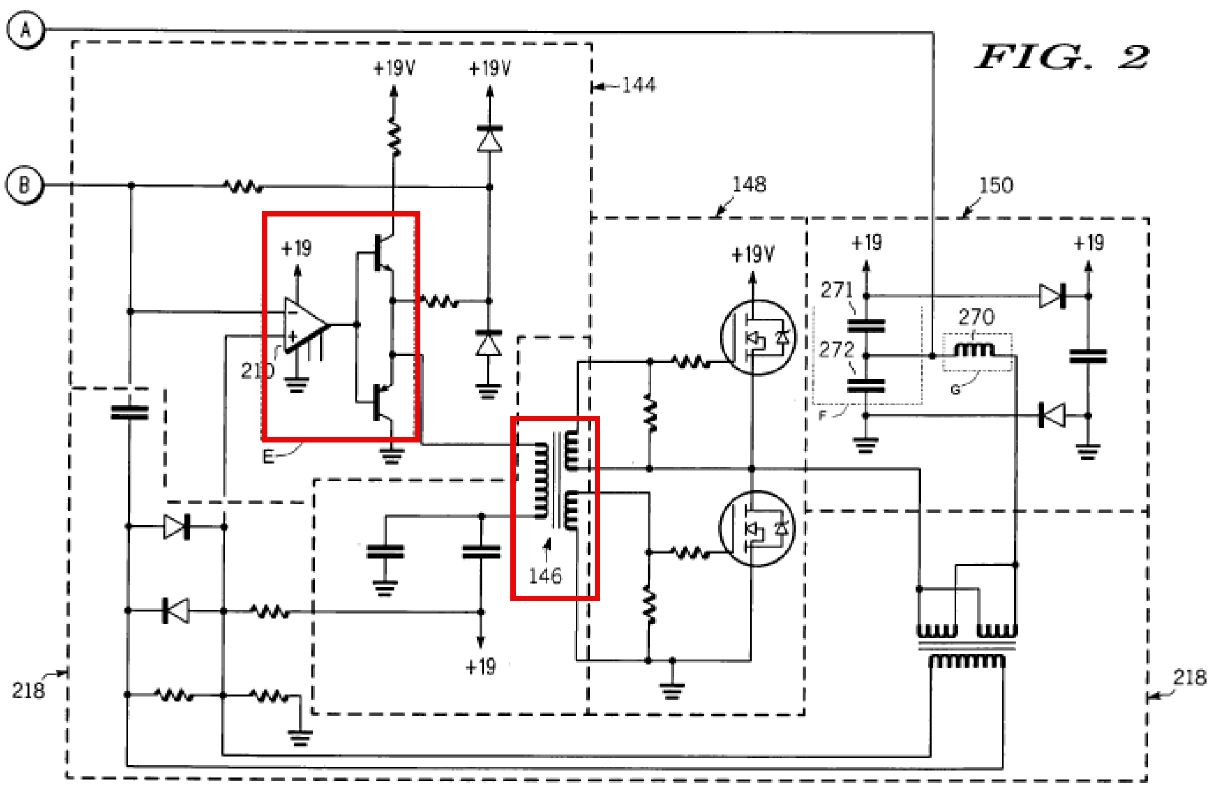
110. The POSITA would understand power source 310 to receive a common AC current and convert that AC current to DC current. Baarman-878 discloses that power source 310 outputs DC current, which the POSITA would

understand to be a constant-voltage current (*e.g.*, based on a constant rail voltage), to inverter 312. (EX1007, 7:46-50, 8:9-12, Fig. 7.) Baarman-878 incorporates Appl. No. 10/246,155, which discloses that in an embodiment, power is provided "from an external power source, such as a conventional power outlet," which the POSITA would understand to provide AC current. (EX1011, 12; EX1007, 3:58-63.) This is analogous to the '568 patent, which describes that, in a "conventional contact-less charging method," a charger 10 receives power from a "common AC power source 20." (EX1001, 1:64-2:4, Fig. 1.) To the extent not expressly disclosed, it would have been obvious for the power source 310 to receive AC current from a conventional power outlet as described in Appl. No. 10/246,155. This is at least because the POSITA would understand that power source 310 must have receive input power from somewhere, but Baarman-878 does not expressly disclose the input power source; the POSITA would have understood the conventional power output to be a desirable input power source at least due to its ubiquity. Further, it would have been obvious to the POSITA for the power source 310 to convert the AC current to DC current, because such conversion would be required for the power source 310 to provide the DC current to inverter 312 as described in Baarman-878.

c. **[B]** ***wherein the high frequency power driving unit includes: a pulse signal generator for receiving a pulse driving signal from the microprocessor and outputting a pulse signal; and***

111. The high frequency power driving unit is met based on Baarman-878. Baarman-878 discloses that in an inductive ballast circuit, a phase delay can be inserted into the high frequency power driving unit (*e.g.*, at point E in the below figure, before drive 146), and used to "delay the signal"; this can be used to "throttle the phase and control secondary amplitude."

FIG. 2



(EX1007, 5:4-6, 6:36-42, Figs. 2 (annotated), 4.)

112. Baarman-878 discloses that the phase delay circuitry may include a delay line or a DSP that is connected to a wave shaper and drive circuit 16. (EX1007, 6:36-42.) The POSITA would understand the circuit including the phase delay, wave shaper, and drive circuit to meet the pulse signal generator at least by receiving a control signal from the microprocessor, *e.g.*, as shown in Fig. 4, and outputting a pulse signal (*i.e.*, a signal with pulses separated by the delays introduced by the circuit):

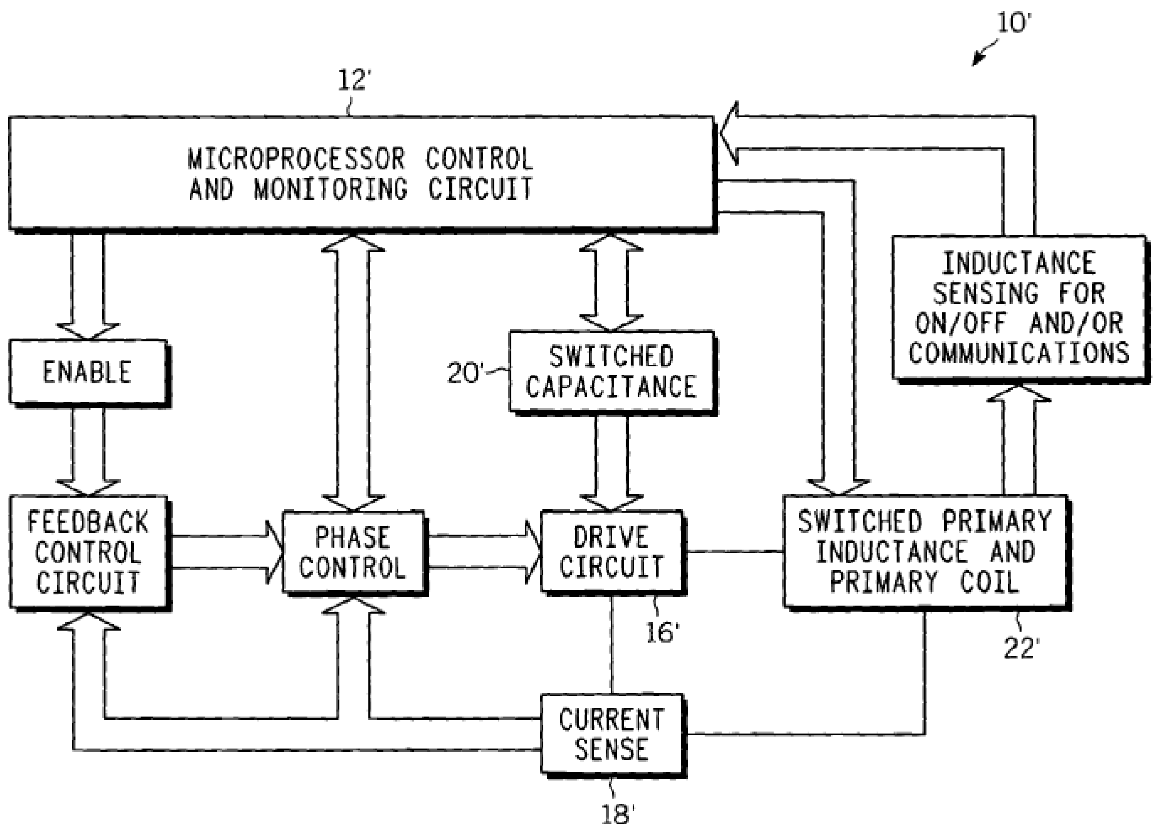


FIG. 4

(EX1007, 6:36-42, Fig. 4.)

d. **[C]** ***a power driving part for receiving the pulse signal to rapidly switch the constant-voltage current input from the constant voltage supplier, thereby generating a high frequency AC current in a pulse pattern.***

113. This element is met based on Baarman-878. For example, as described above for element [B], phase delay circuitry may include a delay line or a DSP that is connected to a wave shaper and drive circuit. (EX1007, 6:36-42.) Baarman-878 discloses, with respect to Fig. 7, that an analogous drive circuit 328 regulates the operation of inverter 312. (EX1007, 8:5-8.) To the extent not expressly disclosed, it would have been obvious to the POSITA for drive circuit 328 to receive a pulse signal via a phase delay circuit as described above for element [B]; and to thereby generate a high frequency AC current in a corresponding pulse pattern via inverter 312. This is at least because Baarman-878 explains that Fig. 7 (along with Figs. 6, 8, and 9) "enhance[s] and explain[s]" the system of Figs. 1-5, such that the drive circuit 328 of Fig. 7 describes an "enhanced" version of the drive circuit 16 or 16' shown in Figs. 1-5. (EX1007, 7:20-21.)

13. Claim 17

114. Claim 17 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging device according to claim 16, wherein***

115. The preamble is met as for claim 16.

b. **[A]** ***the microprocessor adjusts the charging power by modulating a width of a pulse current, a frequency of the pulse current, an amplitude of a pulse, or a number of pulses.***

116. This element is met as for claim 1[D]. For example, the microprocessor adjusts an amplitude of a pulse by adjusting the rail voltage as described for 1[D].

14. Claim 18

117. Claim 18 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging device according to claim 16, wherein***

118. The preamble is met as described above for claim 16.

b. **[A]** ***the power supply includes: an overvoltage filter for receiving a common AC current and intercepting an overvoltage current;***

119. This element is met as for claim 16[A]. (EX1007, 4:58-5:3, Fig. 2.) To the extent not expressly disclosed, it would have been obvious for the power supply to include an overvoltage filter; the POSITA would have understood such a filter to be a basic and well-understood circuit protection component.

c. [B] *a rectifier for rectifying the AC current passing through the filter to convert the AC current into a DC current; and*

120. This element is met as for claim 16[A] and further based on Horowitz. (EX1007, 4:58-5:3, Fig. 2.) To the extent not expressly disclosed, it would have been obvious to the POSITA for the power supply to include a rectifier, such as the bridge rectifier described in Horowitz, to convert AC current to DC current. (EX1019, 46-47, Fig. 1.74.) As described for 1[B], Horowitz discloses that "a rectifier changes ac to dc," and provides multiple examples of rectifiers (*e.g.*, bridge rectifiers) that can be used in power supplies such as in Baarman-878. (EX1019, 46-47, Fig. 1.74.)

d. [C] *a constant voltage supplier that receives the converted DC current and outputs a constant voltage current.*

121. This element is met by Baarman-878. For example, Fig. 2 shows a ballast circuit configured to receive the converted DC current (*e.g.*, 19 volts) and output a constant voltage current (*e.g.*, to tank circuit 150). (EX1007, 4:61-65, Fig. 2.)

15. Claim 19

122. Claim 19 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging device according to claim 13, wherein***

123. The preamble is met as described above for claim 13.

b. **[A]** ***the high frequency power driving unit intermittently applies a high frequency AC current to the magnetic field generating unit, and***

124. This element is met based on Baarman-878. Baarman-878 teaches applying the AC current via a phase delay circuit, used to "delay the signal," as described above for claim 16[B]. (EX1007, 5:4-6, 6:36-42, Figs. 2, 4.) To the extent not expressly disclosed, it would have been obvious to the POSITA that the application of the phase delay circuit would (or could be readily configured to) result in intermittent application of the AC current.

c. **[B]** ***wherein the microprocessor receives the monitoring result while a high frequency AC current is not applied to the magnetic field generating unit.***

125. This element is met as for claim 13[C]. Further, the POSITA would understand that controller 326 receives the monitoring result without regard to whether the high frequency AC current is applied and including in intervals when the current is not applied.

16. Claim 21

126. Claim 21 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A battery charging set including a contact-less chargeable battery and a contact-less charging device,***

127. The preamble is met as for claim 1[Preamble] and claim 13[Preamble].

b. **[A]** ***wherein the contact-less chargeable battery includes: a high frequency AC current inducing unit to which a high frequency AC current is induced by a magnetic field intermittently generated from an external contactless charging device;***

128. This element is met as for claim 1[A]. Further, Baarman-878 teaches using a phase delay circuit to "delay the signal" used to drive the primary winding, as described above for claim 16[B]. (EX1007, 5:4-6, 6:36-42, Figs. 2, 4.) To the extent not expressly disclosed, it would have been obvious to the POSITA that the application of the phase delay circuit to "delay the signal" would (or could be readily configured to) result in intermittent application of the drive signal to the primary winding; which in turn will result in intermittent induction of the AC current in the secondary winding.

c. **[B]** ***a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

129. This element is met as for claim 1[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to a battery cell in a constant voltage/constant current mode; and***

130. This element is met as for claim 1[C].

e. **[D]** ***a first microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier and wirelessly transmitting a monitoring result to the external contact-less charging device while a high frequency AC current is not induced,***

131. This element is met as for claim 1[D]. Further, the POSITA would understand controller 353 to transmit the monitoring result without regard to whether the high frequency AC current is induced and including in intervals when the current is not induced.

f. **[E]** ***wherein the contact-less charging device includes: a magnetic field generating unit for receiving an AC current and forming the magnetic field in an outer space;***

132. This element is met as for claim 13[A].

g. **[F]** ***a high frequency power driving unit for intermittently applying a high frequency AC current to the magnetic field generating unit; and***

133. This element is met as for claim 19[A].

h. **[G]** ***a second microprocessor, while a high frequency AC current is not applied to the magnetic field generating unit, wirelessly receiving the monitoring result and controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that a charging power transmitted from the contact-less charging device to the contact-less chargeable battery is adjusted,***

134. This element is met as for claim 13[C].

i. **[H]** ***wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.***

135. This element is met as for claim 13[D].

17. Claim 23

136. Claim 23 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A method for controlling charging of a contact-less chargeable battery using a contact-less charging device by electromagnetic induction, the method comprising:***

137. The preamble is met as for claim 13[Preamble].

b. **[A]** ***(a) intermittently applying a high frequency AC current to a primary coil provided to the charging device so as to intermittently generate a magnetic field in an outer region;***

138. This element is met as for claim 21[F].

c. **[B]** ***(b) linking a magnetic flux of the generated magnetic field to a secondary coil provided to the battery so as to intermittently output an electromagnetically-induced high frequency AC current;***

139. This element is met as for claims 1[A] and 21[F]. As the POSITA would recognize, magnetic flux of the magnetic field generated from power supply 305 (primary winding 334) is inductively linked to secondary winding 353 by Faraday's Law. (*See* EX1017, 780-89.) Further, Baarman-878 teaches using a phase delay circuit to "delay the signal" used to drive the primary winding, as described above for claim 16[B]. (EX1007, 5:4-6, 6:36-42, Figs. 2, 4.) To the extent not expressly disclosed, it would have been obvious to the POSITA that the application of the phase delay circuit to "delay the signal" would (or could be readily configured to) result in intermittent application of the drive signal to the primary winding; which in turn will result in intermittent induction of the AC current in the secondary winding via the linked magnetic flux.

d. **[C]** ***(c) rectifying the output high frequency AC current to be converted into a DC current;***

140. This element is met as for claim 1[B].

e. **[D]** ***(d) applying the DC current to a battery cell through a constant voltage/constant current supplier so as to charge the battery cell in a constant voltage/constant current mode;***

141. This element is met as for claim 1[C].

f. **[E]** ***(e) monitoring voltages at both ends of the constant voltage/constant current supplier and wirelessly transmitting a monitoring result to the charging device while a high frequency AC current is not induced in the secondary coil; and***

142. This element is met as for claim 21[D].

g. **[F]** ***(f) adjusting a power of the high frequency AC current applied to the primary coil according to the transmitted monitoring result,***

143. This element is met as for claim 13[C].

h. **[G]** ***wherein the adjusting the power of the high frequency AC current applied to the primary coil is based on relative positions of the contact-less chargeable battery and the contact-less charging device.***

144. This element is met as for claim 13[D].

18. Claim 25

145. Claim 25 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less chargeable battery according to claim 1, wherein***

146. The preamble is met as described above for claim 1.

b. **[A]** ***the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.***

147. This element is met as for claim 30[A] below.

19. Claim 26

148. Claim 26 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

> **a. [Preamble]** ***The contact-less chargeable battery according to claim 1, wherein***

149. The preamble is met as described above for claim 1.

> **b. [A]** ***the microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.***

150. This element is met as for claim 1[D] and [E].

20. Claim 27

151. Claim 27 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

> **a. [Preamble]** ***The contact-less chargeable battery according to claim 1, wherein***

152. The preamble is met as described above for claim 1.

> **b. [A]** ***the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.***

153. This element is met as for claim 32[A] below.

21. Claim 28

154. Claim 28 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less chargeable battery according to claim 1, wherein***

155. The preamble is met as described above for claim 1.

b. [A] ***the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.***

156. This element is met as for claim 33[A] below.

22. Claim 29

157. Claim 29 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less chargeable battery according to claim 1, wherein***

158. The preamble is met as described above for claim 1.

b. [A] ***the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.***

159. This element is met as for claim 34[A] below.

23. Claim 30

160. Claim 30 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 7, wherein*

161. The preamble is met as described above for claim 7.

b. [A] *the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

162. This element is met as for claim 1[C] and [D]. As described for 1[D](ii), at least the teachings of the "Logic" circuit disclosed in the NCP1800 Datasheet would be controlled by controller 352, which includes a microprocessor.

24. Claim 31

163. Claim 31 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 7, wherein*

164. The preamble is met as described above for claim 7.

b. [A] ***the microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.***

165. This element is met as for claim 1[B], [C], and [D]. As described for 1[D], controller 352 can control the charging of battery 350 by controlling functions within the inductive power supply. (EX1007, 9:17-29.) For example, controller 352 can use wireless feedback control to manipulate the rail voltage of the power source 310, thereby changing the amplitude of the AC power provided to primary winding 334—and, thus, the amplitude of the induced AC current at secondary winding 353. This accordingly changes the DC input voltage (V_{CC}) provided to the front end of CCCV supply, as described in 1[B] and 1[C].

166. By controlling V_{CC}, controller 352 also controls the battery voltage V_{SNS} at the rear end of the CCCV supply. For example, as the NCP1800 Datasheet teaches, the CCCV supply enters a battery charging mode (in which V_{SNS} increases with the battery charge) based on the value of V_{CC}. (EX1012, 1-4, 7-10, Figs. 2, 14-16.) For example, the CCCV supply will only charge the battery (*i.e.*, in a conditioning phase, current regulation phase, or voltage regulation phase) if V_{CC} is greater than V_{UVLO} and less than V_{OVLO} (indicating that a fault is not present):

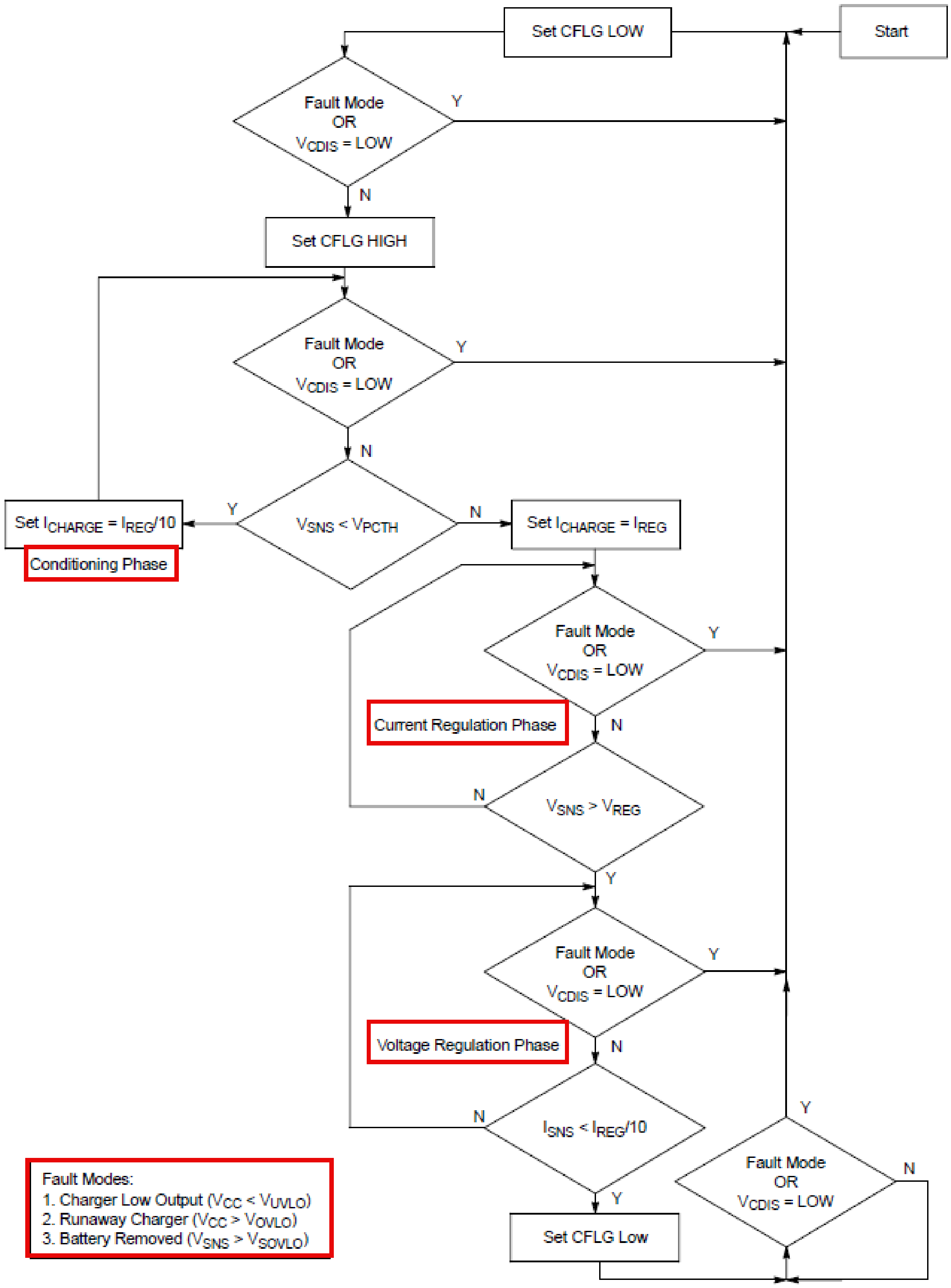


Figure 15. NCP1800 Charging Operational Flow Chart

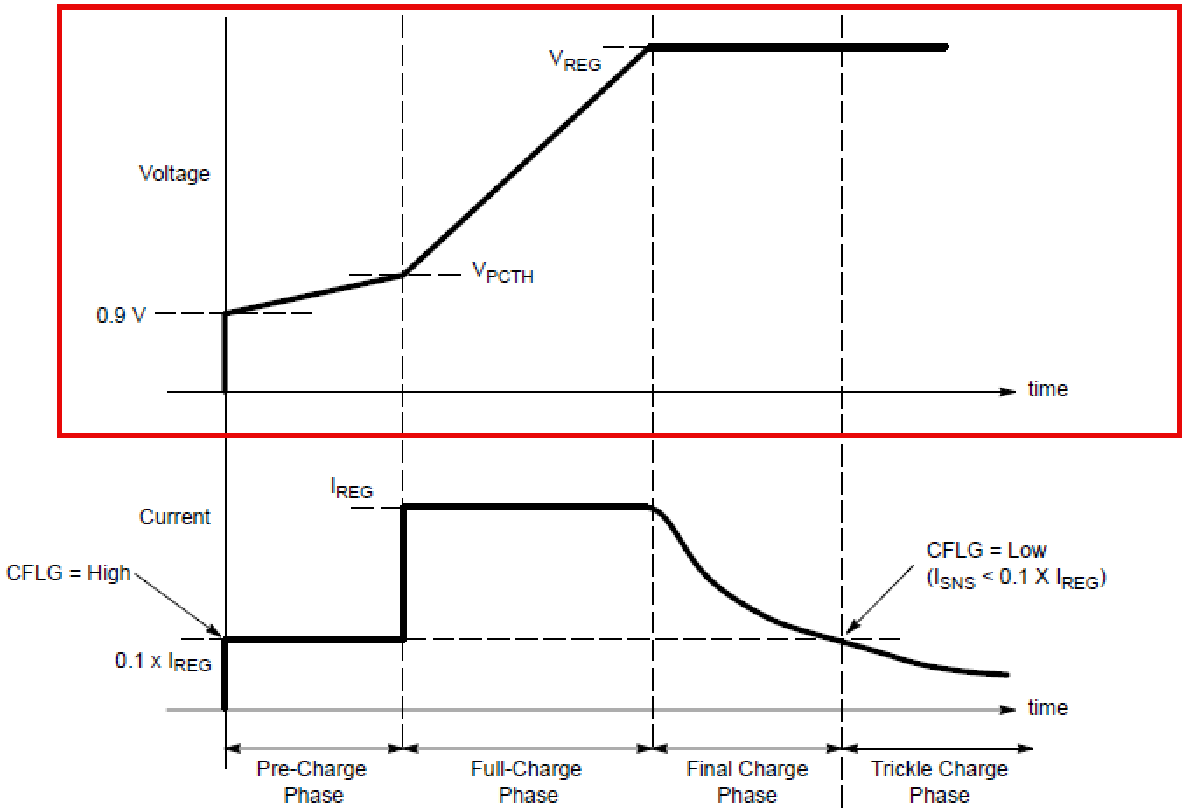


Figure 16. Typical Charging Algorithm

(EX1012, 1-4, 7-10, Figs. 15, 16 (annotated).)

25. Claim 32

167. Claim 32 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 7, wherein*

168. The preamble is met as described above for claim 7.

b. **[A]** ***the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.***

169. This element is met as for claim 1[B] and [C]. As described for 1[B], the rectifier of Horowitz converts an AC input signal to a DC output signal and thus provides a DC current:

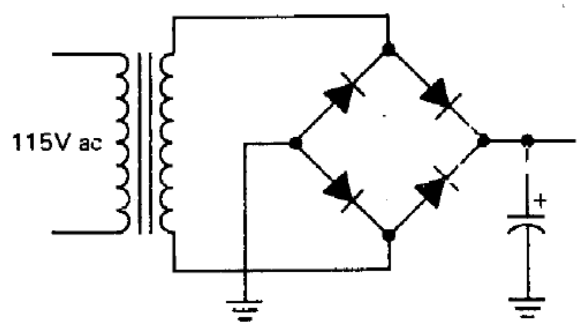


Figure 1.74. **Bridge rectifier circuit. The polarity marking and curved electrode indicate a polarized capacitor, which must not be allowed to charge with the opposite polarity.**

(EX1019, 46-47, Fig. 1.74.)

170. And as described for 1[C], the CCCV supply receives the DC signal (V_{in}) at its front end and charges the battery at the rear end:

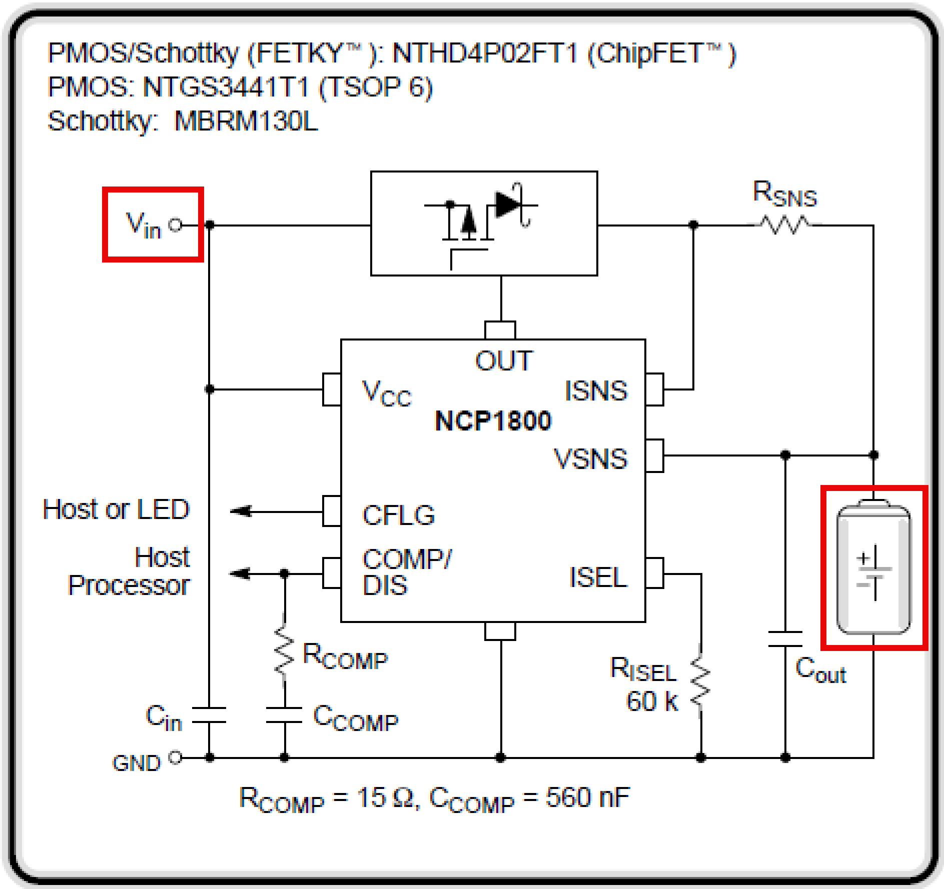


Figure 1. Typical Application

(EX1012, 1, 2, Figs. 1 (annotated), 2.)

26. Claim 33

171. Claim 33 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less charging circuit module according to claim 7, wherein***

172. The preamble is met as described above for claim 7.

b. **[A]** ***the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.***

173. This element is met as for claim 1[C]. For example, the NCP1800 Datasheet discloses charging the battery in an initial constant-current mode (pre-charge phase and full-charge phase), followed by a constant-voltage mode (final charge phase):

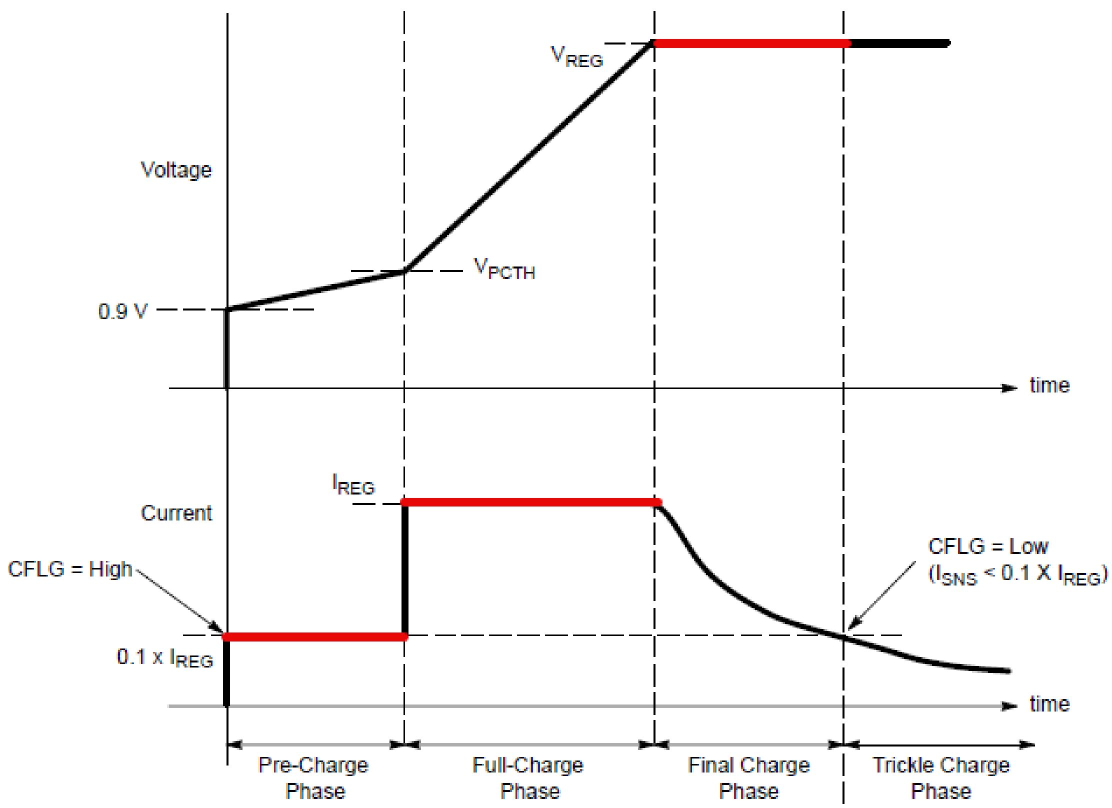


Figure 16. Typical Charging Algorithm

(EX1012, 8-10, Fig. 16 (annotated).)

27. Claim 34

174. Claim 34 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 7, wherein*

175. The preamble is met as described above for claim 7.

b. [A] *the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.*

176. This element is met as for claim 1[C]. For example, the NCP1800 Datasheet discloses that once the battery voltage reaches a second threshold level (V_{REG}), charging power is then provided in a "final charge (voltage regulation)" phase:

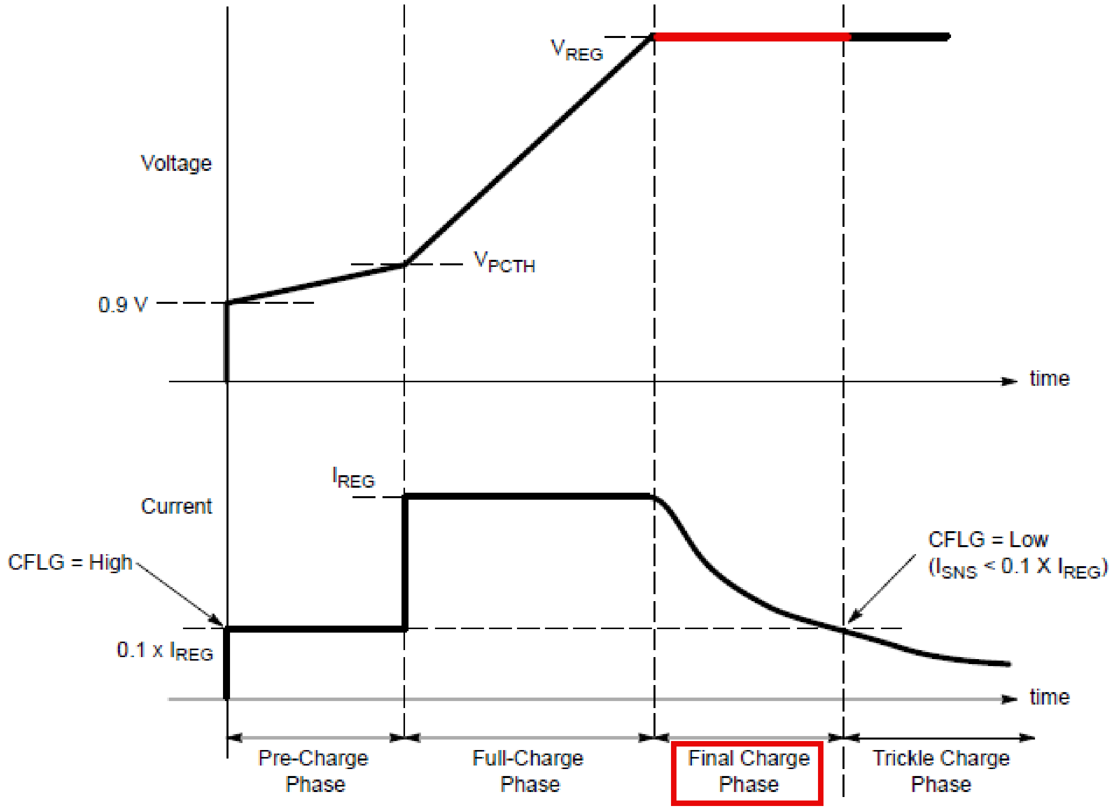


Figure 16. Typical Charging Algorithm

(EX1012, 8-10, Figs. 14, 15, 16 (annotated).)

28. Claim 35

177. Claim 35 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 13, wherein*

178. The preamble is met as described above for claim 13.

b. [A] *the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.*

179. This element is met as for claim 30[A].

29. Claim 36

180. Claim 36 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 13, wherein*

181. The preamble is met as described above for claim 13.

b. [A] *the microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.*

182. This element is met as for claim 31[A].

30. Claim 37

183. Claim 37 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 13, wherein*

184. The preamble is met as described above for claim 13.

b. **[A]** ***the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.***

185. This element is met as for claim 27[A].

31. Claim 38

186. Claim 38 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less chargeable battery according to claim 13, wherein***

187. The preamble is met as described above for claim 13.

b. **[A]** ***the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.***

188. This element is met as for claim 28[A].

32. Claim 39

189. Claim 39 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

190. The preamble is met as described above for claim 21.

b. **[A]** ***the constant voltage/constant current supplier charges the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.***

191. This element is met as for claim 29[A].

33. Claim 40

192. Claim 40 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

193. The preamble is met as described above for claim 21.

b. **[A]** ***the constant voltage/constant current supplier includes circuitry controlled by at least one microprocessor.***

194. This element is met as for claim 30[A].

34. Claim 41

195. Claim 41 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

196. The preamble is met as described above for claim 21.

b. **[A]** ***the microprocessor controls, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing the change of intensity of the magnetic field.***

197. This element is met as for claim 31[A].

35. Claim 42

198. Claim 42 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

199. The preamble is met as described above for claim 21.

b. **[A]** ***the constant voltage/constant current supplier has a front end and a rear end, wherein the constant voltage/constant current supplier receives the DC current at the front end from the rectifier and supplies the charging power at the rear end to the battery cell.***

200. This element is met as for claim 27[A].

36. Claim 43

201. Claim 43 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

202. The preamble is met as described above for claim 21.

b. [A] ***the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage.***

203. This element is met as for claim 28[A].

37. Claim 44

204. Claim 44 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The method of claim 23, further comprising:***

205. The preamble is met as described above for claim 23.

b. [A] ***receiving, by the constant voltage/constant current supplier, the DC current at a front end of the constant voltage/constant current supplier; and***

206. This element is met as for claim 27[A].

c. [B] ***supplying, by the constant voltage/constant current supplier, the DC current at a rear end of the constant voltage/constant current supplier to the battery cell.***

207. This element is met as for claim 27[A].

38. Claim 45

208. Claim 45 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The method of claim 23, further comprising:***

209. The preamble is met as described above for claim 23.

b. **[A]** ***supplying, by the constant voltage/constant current supplier, the DC current to the battery cell in a constant current mode during an initial charging stage and then in a constant voltage mode at a later charging stage.***

210. This element is met as for claim 28[A].

39. Claim 46

211. Claim 46 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The method of claim 23, further comprising:***

212. The preamble is met as described above for claim 23.

b. **[A]** ***charging, by the constant voltage/constant current supplier, the battery cell in a constant voltage mode based on a charging voltage of the battery cell exceeding a predetermined level.***

213. This element is met as for claim 29[A].

40. Claim 47

214. Claim 47 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The method of claim 23, further comprising:***

215. The preamble is met as described above for claim 23.

b. **[A]** ***controlling, through wireless feedback control of the charging of the battery cell, the voltages at both ends of the constant voltage/constant current supplier by inducing a change of intensity of the magnetic field.***

216. This element is met as for claim 1[C].

41. Claim 48

217. Claim 48 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:***

218. The preamble is met as for claim 7[Preamble].

b. **[A]** ***a high frequency AC current inducing unit that includes a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil of an external contact-less charging device;***

219. This element is met as for claim 1[A].

c. **[B]** ***a rectifier receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

220. This element is met as for claim 1[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode, wherein the constant voltage/constant current supplier supplies the charging power in a constant current mode at an initial charging stage and then supplies the charging power in a constant voltage mode at a later charging stage; and***

221. This element is met as for claim 1[C] and claim 33[A].

e. **[D]** ***an overvoltage monitoring unit that includes first and second voltage detectors respectively detecting voltages at both ends of the constant voltage/constant current supplier, and a microprocessor monitoring the detected voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external constant-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field,***

222. This element is met as for claim 1[D].

f. **[E]** ***wherein the microprocessor transmits the monitoring result to induce the change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device to solve an overvoltage state according to relative positions of the primary coil and the secondary coil.***

223. This element is met as for claim 1[D] and [E].

42. Claim 49

224. Claim 49 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less charging circuit module according to claim 48, wherein***

225. The preamble is met as described above for claim 48.

b. [A] ***a magnetic flux of the magnetic field generated from the external contact-less charging device is linked to the secondary coil of the high frequency AC current inducing unit.***

226. This element is met as for claim 8[A].

43. Claim 52

227. Claim 52 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. [Preamble] ***The contact-less charging circuit module according to claim 48, wherein***

228. The preamble is met as described above for claim 48.

b. [A] ***the monitoring result is a charging power adjustment request signal.***

229. This element is met as for claim 11[A].

44. Claim 54

230. Claim 54 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:***

231. The preamble is met as for claim 7[Preamble].

b. **[A]** ***a high frequency AC current inducing unit to which a high frequency AC current is induced by means of a magnetic field generated from an external contact-less charging device;***

232. This element is met as for claim 7[A].

c. **[B]** ***a rectifier receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

233. This element is met as for claim 7[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode,***

234. This element is met as for claim 7[C].

e. **[D]** ***an overvoltage monitoring unit that includes: a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier, and a wireless transmitting unit transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field.***

235. This element is met as for claim 1[D].

f. **[E]** ***wherein the change of intensity of the magnetic field is based on relative positions of the contact-less charging circuit module and the external contact-less charging device.***

236. This element is met as for claim 7[E].

45. Claim 55

237. Claim 55 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:***

238. The preamble is met as for claim 7[Preamble].

b. **[A]** ***a high frequency AC current inducing unit including a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil in an external contact-less charging device;***

239. This element is met as for claim 1[A].

c. **[B]** ***a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

240. This element is met as for claim 1[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and***

241. This element is met as for claim 1[C].

e. **[D]** ***an overvoltage monitoring unit that includes: a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier, and a wireless transmitting unit transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field,***

242. This element is met as for claim 1[D].

f. **[E]** ***wherein the secondary coil is movable relative to the primary coil during the charging of the battery cell by the contact-less charging circuit module, and***

243. This element is met as for claim 1[E].

g. **[F]** ***wherein the monitoring result includes an adjustment request signal being transmitted repeatedly during the battery charging process for adjusting the intensity of the magnetic field.***

244. This element is met as for claim 1[E].

46. Claim 56

245. Claim 56 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:***

246. The preamble is met as for claim 7[Preamble].

b. **[A]** ***a high frequency AC current inducing unit including a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil in an external contact-less charging device;***

247. This element is met as for claim 7[A].

c. **[B]** ***a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

248. This element is met as for claim 7[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and***

249. This element is met as for claim 7[C].

e. **[D]** ***an overvoltage monitoring unit that includes: a microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier, and a wireless transmitting unit transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field,***

250. This element is met as for claim 1[D].

f. **[E]** ***wherein the monitoring result includes an adjustment request signal being transmitted repeatedly during the battery charging process for adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less chargeable battery and the external contact-less charging device.***

251. This element is met as for claim 1[E].

47. Claim 57

252. Claim 57 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging device for transmitting a charging power by means of electromagnetic induction phenomenon to a contact-less chargeable battery that has a constant-voltage/constant current supplier to be capable of being charged in a constant voltage/constant current mode and wirelessly transmits a monitoring result for voltages at both ends of the constant voltage/constant current supplier, the contact-less charging device comprising:***

253. The preamble is met as for claim 13[Preamble].

b. **[A]** ***a magnetic field generating unit for receiving an AC current and forming a magnetic field in an outer space;***

254. This element is met as for claim 13[A].

c. **[B]** ***a high frequency power driving unit for applying a high frequency AC current to the magnetic field generating unit; and***

255. This element is met as for claim 13[B].

d. **[C]** ***a charging power adjusting unit that includes: a wireless receiving unit receiving the monitoring result from the contact-less chargeable battery by means of wireless communication, and a microprocessor controlling the high frequency power driving unit to adjust a power of the high frequency AC current applied to the magnetic field generating unit so that the charging power transmitted to the contact-less chargeable battery is adjusted,***

256. This element is met as for claim 13[C].

e. **[D]** ***wherein the adjustment to the power of the high frequency AC current applied to the magnetic field generating unit is based on relative positions of the contact-less chargeable battery and the contact-less charging device.***

257. This element is met as for claim 13[D].

48. Claim 58

258. Claim 58 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***A contact-less charging circuit module electrically connected to a battery cell and used for charging an electric energy to the battery cell in a contact-less method, the contact-less charging circuit module comprising:***

259. The preamble is met as for claim 7[Preamble].

b. **[A]** ***a high frequency AC current inducing unit that includes a secondary coil to which a high frequency AC current is induced by means of a magnetic field generated from a primary coil of an external contact-less charging device;***

260. This element is met as for claim 1[A].

c. **[B]** ***a rectifier for receiving the induced high frequency AC current and converting the induced high frequency AC current into a DC current;***

261. This element is met as for claim 1[B].

d. **[C]** ***a constant voltage/constant current supplier receiving the DC current from the rectifier and supplying a charging power to the battery cell in a constant voltage/constant current mode; and***

262. This element is met as for claim 1[C].

e. **[D]** ***an overvoltage monitoring unit that includes a microprocessor, the microprocessor monitoring voltages at both ends of the constant voltage/constant current supplier and transmitting a monitoring result to the external contact-less charging device by means of wireless communication so as to induce a change of intensity of the magnetic field,***

263. This element is met as for claim 1[D].

f. **[E]** ***wherein the change of intensity of the magnetic field includes a change of intensity of the magnetic field by adjusting a power applied to the primary coil of the external contact-less charging device based on relative positions of the contact-less charging circuit module and the external contact-less charging device.***

264. This element is met as for claim 1[E].

B. Ground 2: Claims 3, 4, 6, 9, 10, 12, 20, 22, 24, 50, 51, and 53 are Rendered Obvious Based On Baarman-878 in View of NCP1800 Datasheet, Veselic, And Horowitz

1. Summary of Veselic

265. Veselic is a U.S. Patent issued to inventors Dusan Veselic and Martin G.A. Guthrie. The underlying application (Appl. No. 10/372,180) was filed on February 21, 2003; and the patent issued on September 7, 2010. Veselic is thus prior art to the ’568 patent under at least 35 U.S.C. §§102(a) and (e).

266. Veselic relates to battery charging circuits, such as for portable communication devices with internal batteries. (EX1013, 1:4-21.) Veselic describes monitoring a battery charging controller, such as the NCP1800, in order to modulate the current to the battery to keep the dissipated power below a predetermined level. (EX1013, 4:3-61.) This can be used to adapt the battery charger to current-limited power sources, such as computer data ports. (*Id.*)

267. Veselic is analogous art to the claimed invention at least because it is directed to solving the same problem (battery charging) in the same field of endeavor (electronic circuits) as the ’568 patent. (EX1012, 1, 7.) For example, the battery charge controller 20 disclosed in Veselic is analogous to the constant voltage/constant current supplier 290 disclosed in the ’568 patent, and performs the analogous function of charging a battery cell in a constant voltage or constant

current mode. (*See, e.g.*, EX1012, 1, 7; EX1007, 7:33-42.) Veselic further is directed to monitoring overvoltage conditions and adjusting the charging power accordingly, analogous to the overvoltage monitoring described in the '568 patent. Veselic is thus reasonably pertinent to the problem of battery charger design faced by the inventor of the '568 patent.

2. Claim 3

268. Claim 3 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 1, wherein:*

269. The preamble is met as described above for Ground 1, claim 1.

b. [A] *the overvoltage monitoring unit includes: a wireless transmitting unit for wirelessly propagating the monitoring result through an antenna; and*

270. This element is met as for Ground 1, claim 1[D]. For example, remote transceiver 356 wirelessly transmits the monitoring result via Wi-Fi, infrared, Bluetooth, cellular, or an RFID (Radio Frequency Identification) tag. (EX1007, 9:36-40, Fig. 8.) The POSITA would understand these wireless communication technologies to include propagating signals using an antenna. (*See* EX1018, 21-23.) For example, the POSITA would have understood that in a Wi-Fi network, computer devices use a radio modem and an antenna to wirelessly

communicate data. (*See* EX1018, 21-23.) Similarly, the POSITA would have understood devices communicating via Bluetooth, cellular, and RFID to include an antenna for wireless transmission.

c. [B] *a voltage comparator for comparing the first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result; and*

271. This element is met. As described for Ground 1, claim 1[C], the NCP1800 Datasheet describes the NCP1800 component, which is a CCCV supply; and teaches detecting a first voltage (VCC) at its front end, and detecting a second voltage (V_{SNS}) at its rear end:

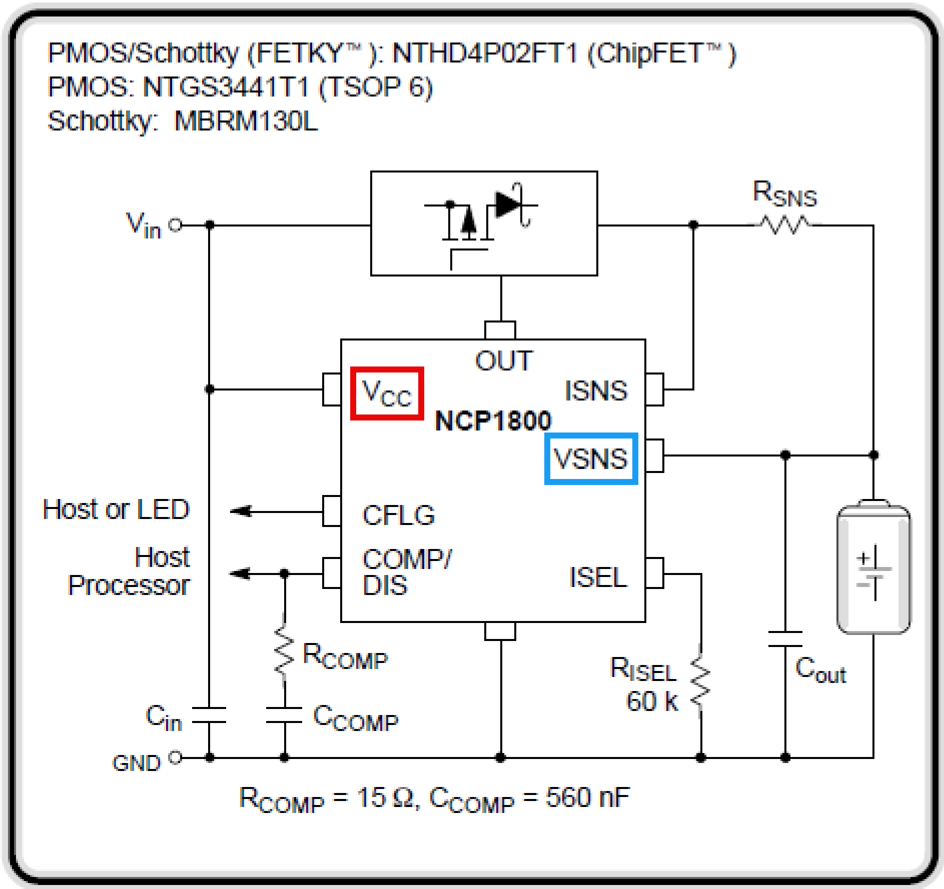
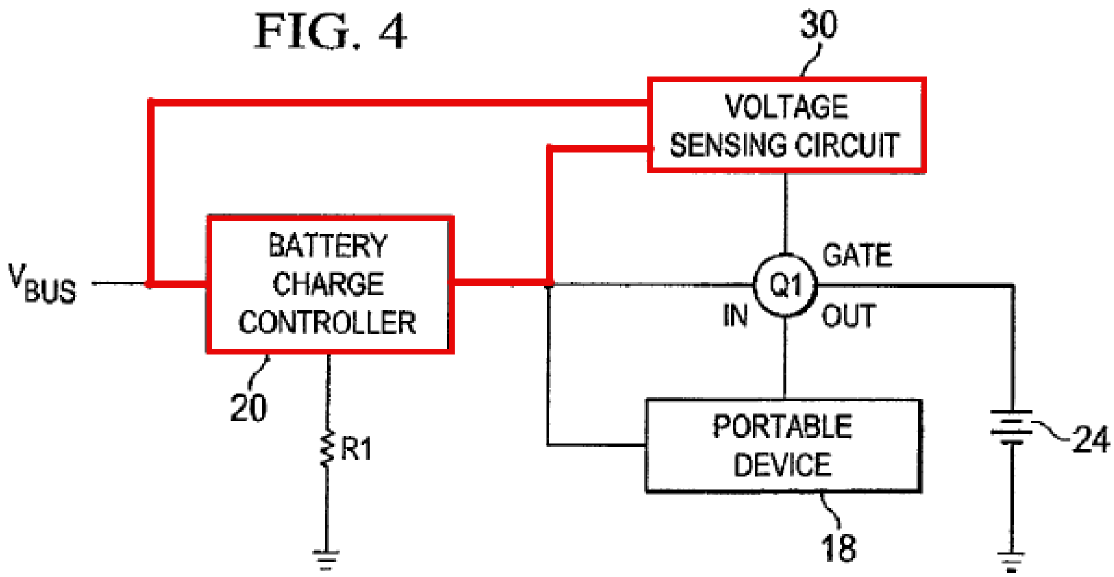


Figure 1. Typical Application

(EX1012, 1, 2, Fig. 1 (annotated).)

272. The NCP1800 Datasheet does not expressly disclose a voltage comparator for comparing the first and second voltages. However, Veselic discloses using a voltage sensing circuit 30 to measure a voltage drop across a battery charge controller 20 (such as the NCP1800 circuit):

FIG. 4



(EX1013, 5:30-64, 7:56-8:8, Figs. 4 (annotated), 6, 8.)

273. The voltage sensing circuit 30 measures the voltage drop by "comparing the voltage at the input and voltage at the input and output of the battery charge controller 20," *e.g.*, using an op-amp. (EX1013, 5:55-60.) The POSITA would thus recognize voltage sensing circuit 30 as disclosing a voltage comparator.

d. [C] *the microprocessor outputs the monitoring result according to the voltage comparison result to the wireless transmitting unit.*

274. This element is met as described for Ground 1, claim 1[D]. The POSITA would have combined Baarman-878, NCP1800 Datasheet, and Veselic such that controller 352 would implement Veselic's voltage sensing circuit 30; and

would output a result via remote transceiver 356 according to Veselic's voltage comparison.

275. As described for Ground 1, claim 1[D], the POSITA would have utilized controller 352, in view of the NCP1800 Datasheet, to control the battery charging "precisely and safely" by communicating control signals to the power supply controller 326. For example, as described above, controller 352 would use the results of monitoring V_{CC} and V_{SNS} to reduce the rail voltage of power source 310, thus lowering the intensity of the induced AC current. Veselic's voltage comparison indicates the power consumption of the circuit (*i.e.*, as the product of the voltage drop and the current). (EX1013, 5:43-54.) Controller 352 thus would additionally use the results of Veselic's voltage comparison to determine whether the power consumption of the circuit is too great; and if so, to accordingly reduce the current to the battery (*e.g.*, by reducing the rail voltage), as described in Veselic. (EX1013, 5:65-6:24, 13:15-57, Fig. 8.) Veselic expressly discloses that a microcontroller, such as controller 352, can be used to implement the voltage drop measurement. (EX1013, 13:41-45.)

(i) Motivation to combine

276. The POSITA would have been motivated to realize technical advantages described in Veselic: controlling power consumption to stay within the limits of the power source, and mediating power competition between the battery

and a portable device. (EX1013, 5:65-6:24.) This is especially pertinent to Baarman-878, which discloses that remote device 338 may include a power-hungry portable device such as a digital camera or a PDA. (EX1007, 9:49-58.) Further, Veselic's voltage comparison also may beneficially permit a battery to be charged from a USB power source, such as a USB port of workstation 307, to which Baarman-878's charging device 305 may be connected. (EX1013, 2:3-3:67; EX1007, Fig. 6.)

277. Veselic relates to battery chargers for portable communication devices, such as described in Baarman-878 and the NCP1800 Datasheet; and incorporates well-known electronic components (batteries, microcontrollers) analogous to those of Baarman-878. (EX1013, 1:4-8, 13:15-26.) Further, Veselic expressly invites its combination with the NCP1800 circuit, describing it as a "standard" controller "known in the art," for which "application notes" are available to "assist the designer." (EX1013, 7:7:49-8:12, Fig. 6.) And Veselic explains that a benefit of its techniques is that it allows battery charge controllers to be used "off the shelf," without redesign. (EX1013, 6:9-17.) Thus the POSITA would have enjoyed a reasonable expectation of success in combining Veselic with Baarman-878 and the NCP1800 Datasheet.

3. Claim 4

278. Claim 4 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. [Preamble] *The contact-less chargeable battery according to claim 3, wherein*

279. The preamble is met as described above for claim 3.

b. [A] *the magnetic field generated by the external contact-less charging device is generated intermittently,*

280. This element is met as for Ground 1, claim 21[A].

c. [B] *wherein the microprocessor receives an end time point signal indicating a time point when the induction of high frequency AC current ends, wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.*

281. This element is met. To the extent not expressly disclosed, it would have been obvious to communicate to the controller 353 a time point signal indicating the timing of the phase delay described for Ground 1, claim 21[A], so that wireless communications from controller 353 could be coordinated accordingly. Further, it would have been obvious for this coordination to include transmitting the monitoring result while the AC current is not induced, so as to minimize electromagnetic interference between the wireless communication of the

monitoring result and the induction of the AC current. This is especially so because Baarman-878 discloses that transceivers 336 and 356 can communicate wirelessly via coils on the primary and secondary windings; this configuration makes the risk of electromagnetic interference particularly acute, because common windings are utilized for inducing the AC current and communicating the monitoring result. (EX1007, 9:41-44.)

4. Claim 6

282. Claim 6 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

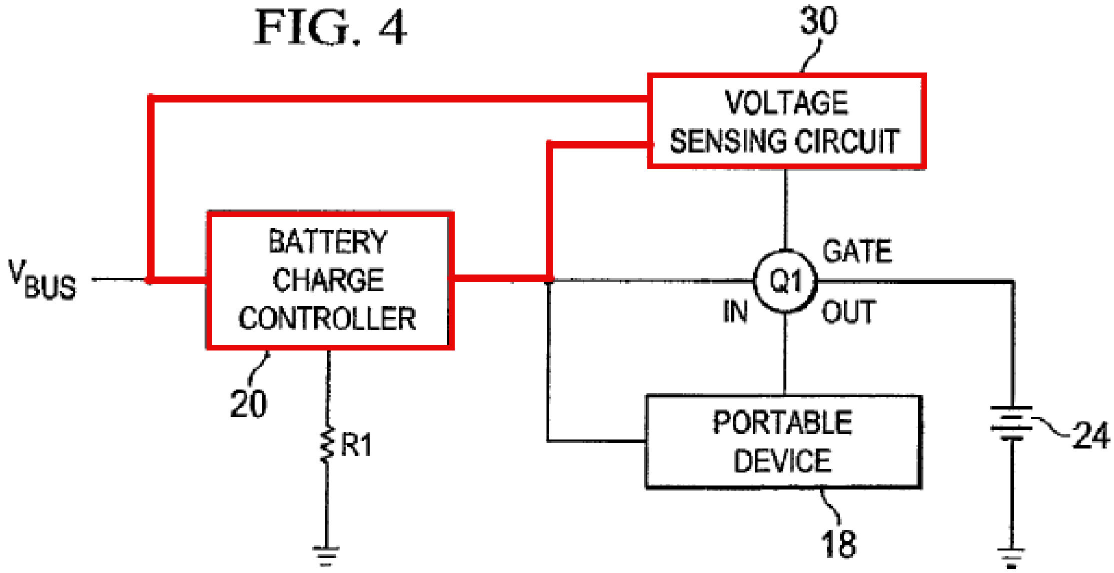
a. [Preamble] *The contact-less chargeable battery according to claim 1, wherein*

283. The preamble is met as described for Ground 1, claim 1.

b. [A] *the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values of both ends, or a code indicating that the voltages at both ends are in an overvoltage state.*

284. This element is met based on Baarman-878 in view of NCP1800 Datasheet and Veselic. For example, as described above for claim 3[B], Veselic discloses "monitoring the voltage drop across the battery charge controller 20":

FIG. 4



(EX1013, 5:30-6:3, 7:56-8:8, Figs. 4 (annotated), 6, 8.)

285. The POSITA would understand the voltage drop to be a difference of voltages at both ends of the battery charge controller 20, which is a constant voltage/constant current supplier to a battery. (EX1013, 6:25-52.)

286. To the extent not expressly disclosed, it would have been obvious to the POSITA for the monitoring result to be the voltage drop. For example, Veselic teaches monitoring the voltage drop, and using the result of that monitoring to "modulate the power to the battery 24," *e.g.*, to limit the amount of power provided to the battery. (EX1013, 5:65-6:17.) As described above for claim 1[D](iii), Baarman-878 performs an analogous function by using its controller 352 to wirelessly transmit control signals from remote device 338 to the power supply

controller 326. (EX1007, 8:47-51, 9:17-29, Fig. 7.) As described, those control signals can manipulate the rail voltage of the power source 310, changing the amplitude of inverter 312 and thus the amount of power provided to the battery 350—analogous to the power modulation of Veselic. (EX1007, 7:46-51, 8:41-51.)

287. The POSITA would have applied Veselic's monitoring result (the voltage drop) to the wirelessly transmitted control signals of Baarman-878. That is, the POSITA would have applied the monitoring result of Veselic as a control signal transmitted to power supply controller 326, such that the power supply controller 326 adjusts a power applied to the primary winding 334, as described for claim 1[D]. The POSITA would have been motivated to make the combination as described above for claim 3. Further, as described above for claim 1[D](iii), Baarman-878 does not detail the exact nature of the control signals transmitted to the power supply controller, motivating the POSITA to consult other prior art references, such as Veselic, for this information.

288. The POSITA would have applied Veselic's teachings in order to realize the specific benefits described in Veselic. For example, Veselic explains that the voltage drop can be used to compute and control the "total power" dissipated by the battery charge controller, such that the power source's limits are not exceeded, while ensuring that the target device receives the power it requires for operation. (EX1013, 5:65-6:17.) This beneficially avoids having to design

"new and larger battery charge controllers," while allowing the battery charge controller to be kept physically small—advantages that the POSITA would have sought to realize by the combination. (EX1013, 6:9-17.)

5. Claim 9

289. Claim 9 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 7, further comprising:*

290. The preamble is met as described above for Ground 1, claim 7.

b. [A] *an antenna;*

291. This element is met as for claim 3[A].

c. [B] *first and second voltage detectors for respectively detecting first and second voltages at front and rear ends of the constant voltage/constant current supplier; and*

292. This element is met as for Ground 1, claim 1[D].

d. [C] *a voltage comparator for comparing the first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result, and*

293. This element is met as for claim 3[B].

e. [D] *wherein the microprocessor outputs the monitoring result according to the voltage comparison result using the antenna.*

294. This element is met as for claim 3[C].

6. Claim 10

295. Claim 10 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. [Preamble] *The contact-less charging circuit module according to claim 9, wherein*

296. The preamble is met as described above for claim 9.

b. [A] *the magnetic field generated by the external contact-less charging device is generated intermittently,*

297. This element is met as for claim 4[A].

c. [B] *wherein the microprocessor receives a time point indicating when the induction of high frequency AC current ends, and then outputs the end time point to the microprocessor, and*

298. This element is met as for claim 4[B].

d. [C] *wherein the monitoring result is wirelessly transmitted to the external contact-less charging device while a high frequency AC current is not induced after the end time point is input.*

299. This element is met as for claim 4[B].

7. Claim 12

300. Claim 12 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging circuit module according to claim 7, wherein***

301. The preamble is met as described for Ground 1, claim 7.

b. **[A]** ***the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.***

302. This element is met as for claim 6[A].

8. Claim 20

303. Claim 20 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging device according to claim 13, wherein***

304. The preamble is met as described for Ground 1, claim 13.

b. **[A]** ***the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.***

305. This element is met as for claim 6[A].

9. Claim 22

306. Claim 22 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The battery charging set according to claim 21, wherein***

307. The preamble is met as described for Ground 1, claim 21.

b. **[A]** ***the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.***

308. This element is met as for claim 6[A].

10. Claim 24

309. Claim 24 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The method according to claim 23, wherein***

310. The preamble is met as described for Ground 1, claim 23.

b. **[A]** ***the monitoring result is a difference of voltages at both ends of the constant voltage/constant current supplier, voltage values at both ends, a code indicating that the voltages at both ends are in an overvoltage state, or a charging power adjustment request signal.***

311. This element is met as for claim 6[A].

11. Claim 50

312. Claim 50 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. **[Preamble]** ***The contact-less charging circuit module according to claim 48, wherein:***

313. The preamble is met as described above for Ground 1, claim 48.

b. **[A]** ***the overvoltage monitoring unit further comprises: a wireless transmitting unit wirelessly propagating the monitoring result through an antenna; and;***

314. This element is met as for claim 3[A].

c. **[B]** ***a voltage comparator for comparing the first and second voltages detected by the first and second voltage detectors and outputting a voltage comparison result, and***

315. This element is met as for claim 3[B].

d. **[C]** ***the microprocessor outputs the monitoring result according to the voltage comparison result to the wireless transmitting unit.***

316. This element is met as for claim 3[C].

e. **[D]** ***wherein the microprocessor outputs the monitoring result according to the voltage comparison result using the antenna.***

317. This element is met as for claim 3[A] and [C].

12. Claim 51

318. Claim 51 is met based on Baarman-878 in view of NCP1800 Datasheet, Veselic, and Horowitz.

a. **[Preamble]** ***The contact-less charging circuit module according to claim 50, wherein***

319. The preamble is met as described above for claim 50.

b. **[A]** ***the magnetic field generated by the external contact-less charging device is generated intermittently,***

320. This element is met as for claim 4[A].

c. **[B]** ***wherein the overvoltage monitoring unit further includes a charging pause detecting unit receiving the high frequency AC current output from the high frequency AC current inducing unit to detect a time point when the induction of high frequency AC current ends, and then outputting the end time point to the microprocessor, and***

321. This element is met as for claim 4[B].

d. **[C]** ***wherein the monitoring result is transmitted to the external contact-less charging device by means of wireless communication while a high frequency AC current is not induced after the end time point is input.***

322. This element is met as for claim 4[B].

13. Claim 53

323. Claim 53 is met based on Baarman-878 in view of NCP1800 Datasheet and Horowitz.

a. **[Preamble]** ***The contact-less charging circuit module according to claim 48, wherein***

324. The preamble is met as described for Ground 1, claim 48.

b. [A] ***the monitoring result is a difference of voltages at front and rear ends of the constant voltage/constant current supplier, voltage values of the front and rear ends, or a code indicating that the voltages at both ends are in an overvoltage state.***

325. This element is met as for claim 6[A].

C. Ground 3: Claims 1, 3, 7-9, 11, 12, 30-34, 48-50, 52, and 53 are Rendered Obvious Based On Baarman-267 in View of Veselic

1. Summary of Baarman-267

326. Baarman-267 is a U.S. Patent issued to inventor David W. Baarman. The underlying application (Appl. No. 10/689,375) was filed on October 20, 2003; and issued as a patent on April 14, 2009. Baarman-267 is thus prior art to the ’568 patent under at least 35 U.S.C. §§102(a) and (e).

327. Baarman-267 discloses an adapter for coupling a remote device with a rechargeable power source (*i.e.*, a battery) to a contactless power supply (CPS) via a contactless power interface, and a power regulator for supplying power to the remote device. (EX1014, 1:56-2:31.) The adapter may have a battery for powering the adapter, a first transceiver for communicating with the contactless power supply, and a second transceiver for communicating with the remote device. (*Id.*) The adapter obtains charging information from the remote device, and provides charging information to the CPS. (*Id.*) Power is then supplied to the remote device. (*Id.*)

328. Baarman-267 incorporates by reference four contemporaneously-filed patent applications: Appl. No. 10/689,499 (EX1008); Appl. No. 10/689,224 (EX1009); Appl. No. 10/689,154 (EX1015); and Appl. No. 10/689,148, now Baarman-878 (EX1007). (EX1014, 1:14-21.)

329. Baarman-267 is analogous art to the claimed invention at least because it is directed to solving the same problem (contactless battery charging) in the same field of endeavor (electronic circuits) as the ’568 patent; and provides disclosures analogous to those of the ’568 patent. For example, Baarman-267 describes a contactless power supply for charging a remote device having a battery (*e.g.*, a mobile phone); and utilizing wireless feedback from the remote device to adjust the operation of the power supply. (*See, e.g.*, EX1014, 1:25-2:34, Abstract.) This is analogous to the ’568 patent’s wireless charger for charging a device such a mobile phone, and using wireless feedback from the device to control the charger. (EX1001, 1:19-63, Abstract.) Baarman-267 is thus reasonably pertinent to the problem of battery charger design faced by the inventor of the ’568 patent.

2. Claim 1

330. Baarman-267 in view of Veselic meets Claim 1, as described below.

a. [Preamble]

331. The preamble is met as described in Section VI.A.1. For example, Baarman-267 discloses a contactless chargeable battery in which a remote device

12 with an adapter 14 is powered wirelessly by CPS 10. (EX1014, 2:54-3:2, Fig. 2.) The contactless chargeable battery includes a charging circuit for charging battery cell 20, as shown in Fig. 3:

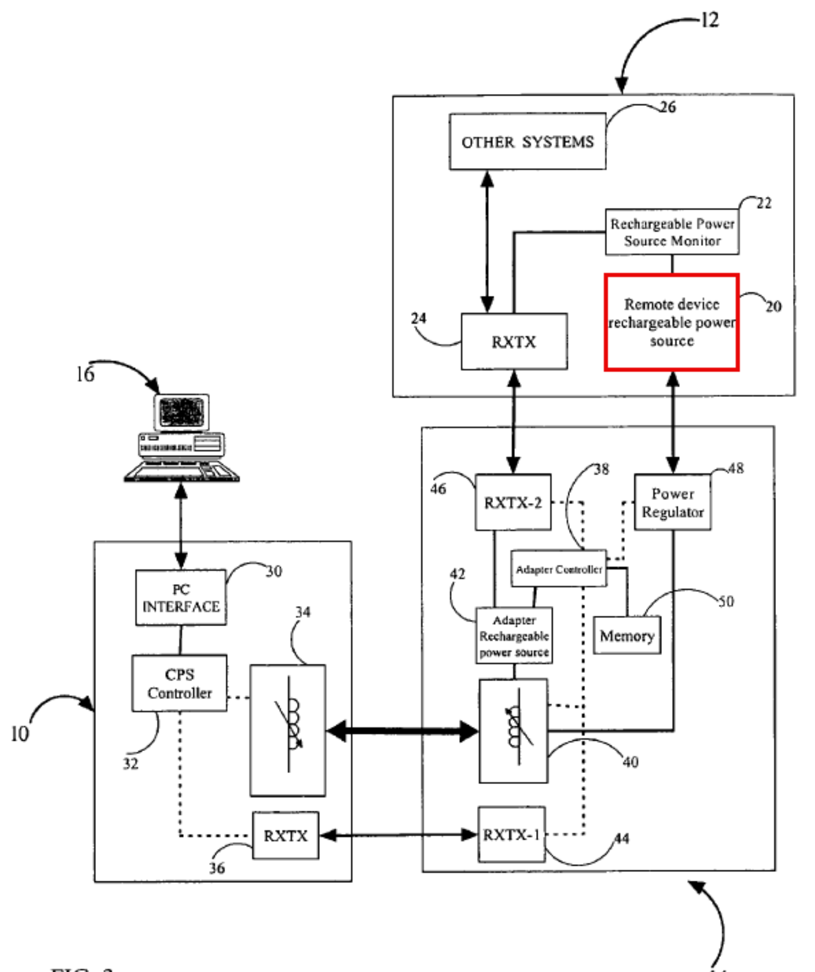


FIG. 3

(EX1014, 3:3-7, Fig. 3.)

b. Element [A]

332. This element is met based on Baarman-267. For example, Baarman-267's battery charging systems use magnetic induction to wirelessly transfer

energy from a primary coil in the CPS 10 to a secondary coil in the adapter 14. (EX1007, 1:33-51.) Baarman-267 discloses that CPS 10 becomes inductively coupled to adapter 14 when in the presence of the adapter:

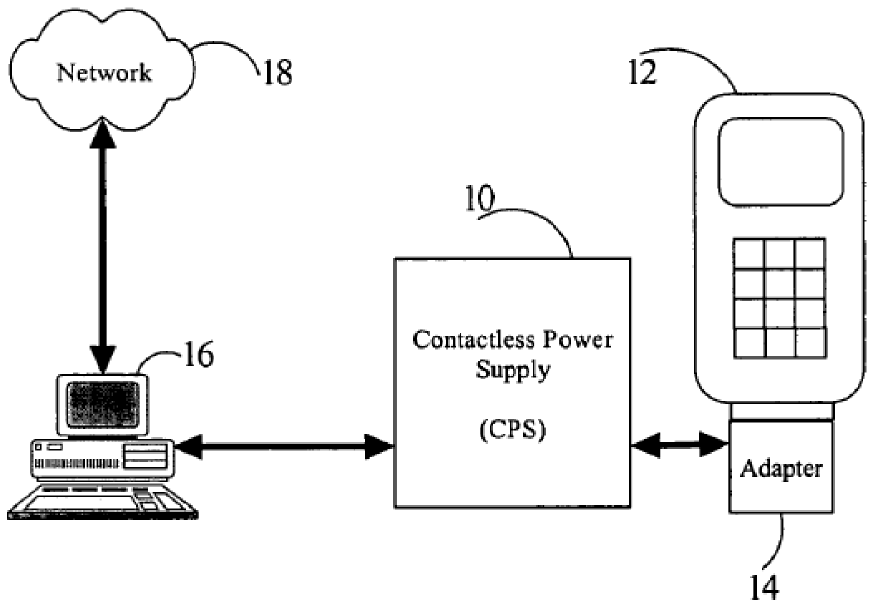


FIG. 2

(EX1014, 2:54-3:2, Fig. 2.)

333. CPS 10 includes power interface 34, which is "more fully described" in Appl. No. 10/689,499 (EX1008, "Baarman-499"), which is incorporated by reference by Baarman-267. (EX1014, 3:37-43.) Baarman-499, in the context of Baarman-267, explains that power interface 34 includes a primary coil that receives AC current from a power source and an inverter in the generation of a magnetic field. (EX1008, 11-14.) The POSITA would understand this to generate

a magnetic field at the primary coil by the Biot-Savart Law. (*See* EX1016, 112-113; EX1017, 589-601.) The POSITA would further understand this magnetic field to induce an AC current in a nearby secondary coil of adapter 14 by Faraday's Law. (*See* EX1016, 112-113; EX1017, 780-89.)

334. Adapter 14 includes secondary coils (*e.g.*, 202, 204, 206) that are connected in parallel to the load and receive AC current from the primary coil via induction. (EX1014, 5:62-6:11, Figs. 6-8.) Current induced in the coils is combined and provided to the input of the power regulator 48 (218). (EX1014, 5:62-6:11, Figs. 6-8.) Fig. 6 illustrates:

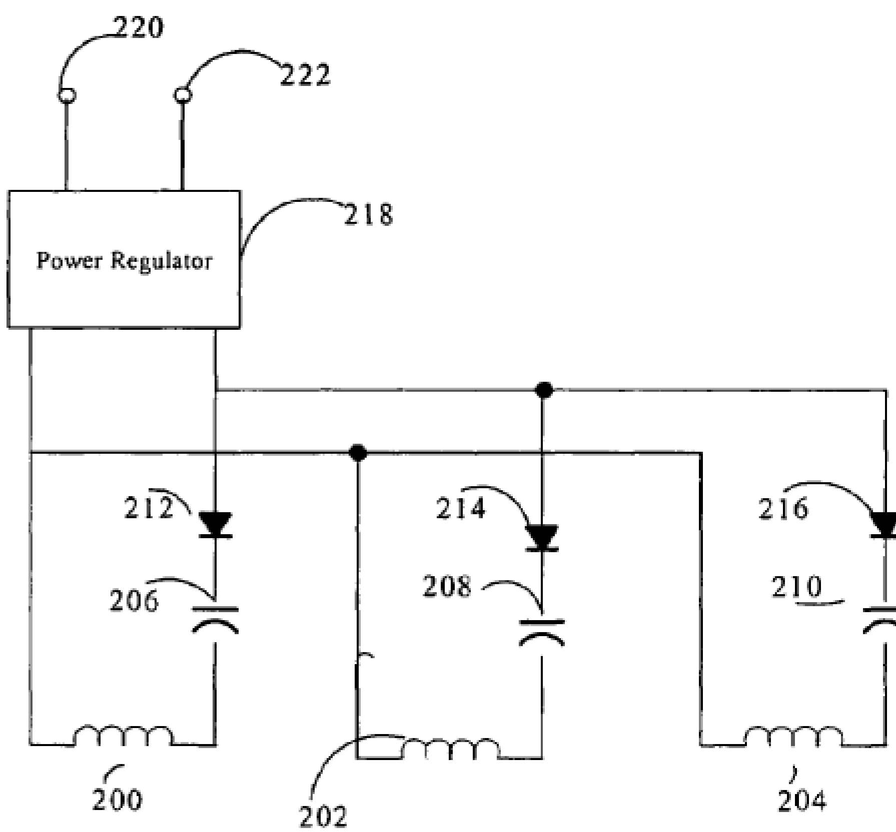


FIG. 6

(EX1014, Fig. 6.)

335. The induced AC current meets the claimed “high frequency” AC current at least as described for Ground 1, claim 1[A]. That is, Baarman-267 incorporates by reference a patent application that discloses an induced AC current of approximately 100 KHz, which is on the order of (and higher than) the example “high frequency AC current” provided in the ’568 patent. (EX1011, 28; EX1007, 3:58-63; EX1014, 1:14-21.)

c. Element [B]

336. This element is met based on Baarman-267. Baarman-267 discloses that adapter 14 includes a rectifier circuit. (EX1014, 6:1-53, Figs. 6-8.) For example, Fig. 7 shows an adapter with a “half-wave rectifier”:

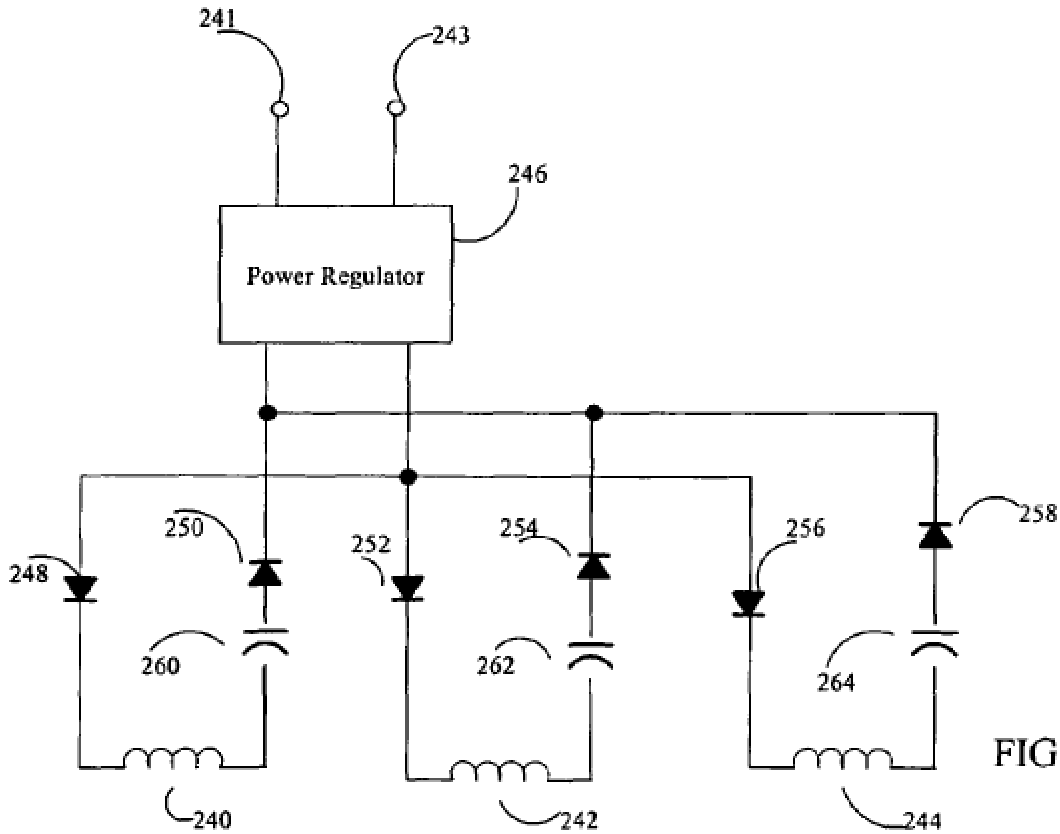


FIG. 7

(EX1014, 6:17-30, Fig. 7.)

337. As illustrated, the rectifier circuit receives induced AC current from secondary coils 240, 242, 244, which the POSITA would understand to be analogous to coils secondary 202, 204, 206 described above. (EX1014, 6:17-30, Fig. 7.) The rectifier converts (rectifies) the induced AC current to DC current via diodes (248, 250, 252, 254, 256, 258) and capacitors (260, 262, 264), and provides it to power regulator 246. (EX1014, 6:17-30, Fig. 7.)

d. Element [C]

338. This element is met based on Baarman-267. Baarman-267 discloses that power regulator 246 receives DC current from a rectifier as described above for element [B]; and supplies charging power to the battery cell 20 by providing a “constant voltage and constant current” (“CCCV”) at its output terminals 241, 243. (EX1014, 4:7-44, 6:17-26, 6:45-53, Fig. 7.)

e. Element [D]

339. This element is met based on Baarman-267 in view of Veselic. For example, the overvoltage monitoring unit is met by at least by adapter 14’s power regulator 48 (which is controlled by adapter controller 38), implementing the teachings of Veselic.

(i) Motivation to combine Baarman-267 and Veselic

340. Baarman-267 discloses that power regulator 48 provides a constant voltage and constant current at its output, and that adapter controller 38 can control the voltage and current output of power regulator 48 to the battery cell 20; but Baarman-267 does not explain how this functionality is implemented. Accordingly, the POSITA would have looked to other references to guide the implementation of the power regulator 48 and adapter controller 38.

341. Veselic, in the same field of endeavor (contactless battery charging), discloses a circuit, including battery charge controller 20, that charges a battery 24

via a CCCV process. (EX1013, 5:30-42, 6:25-7:14.) Veselic's battery charge controller 20 is analogous to power regulator 48 and adapter controller 38 of Baarman-267, which work together to provide a CCCV output to charge Baarman-267's battery cell 20. (EX1014, 6:1-53.)

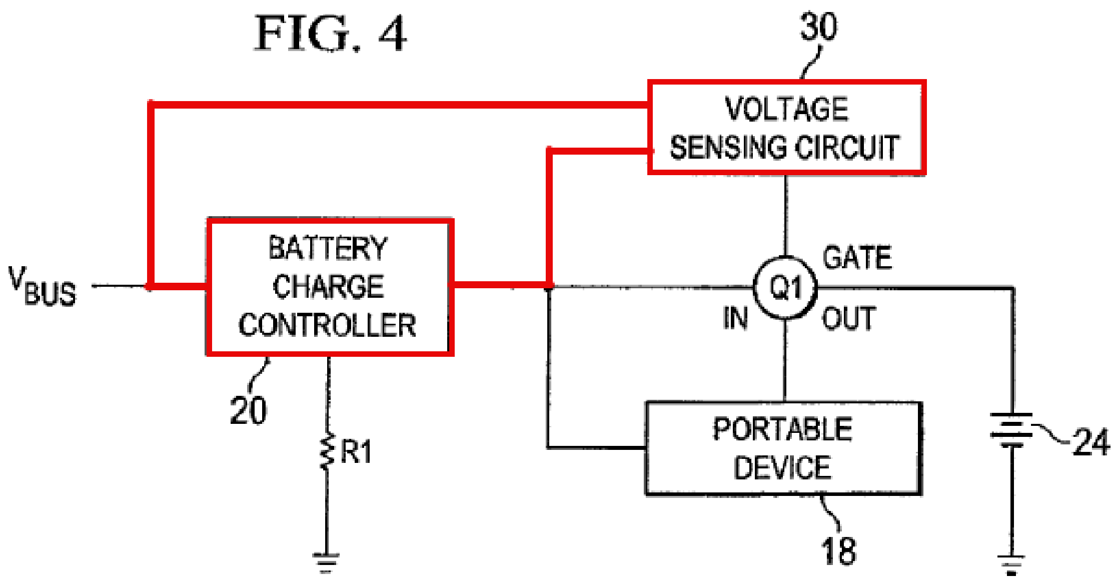
342. Veselic teaches implementing the CCCV supply using a voltage comparator to convey technical advantages: controlling power consumption to stay within the limits of the power source, and mediating power competition between the battery and a portable device. (EX1013, 5:65-6:24.) In particular, Veselic teaches charging a battery from a USB power source, such as a USB port of Baarman-267's PC 16, to which CPS 10 may be connected. (EX1013, 2:3-3:67; EX1014, Fig. 2.) The POSITA thus would have been motivated to combine Baarman-267 with the teachings of Veselic, *i.e.*, to implement power regulator 48 and adapter controller 38, to realize these specific advantages.

343. Further, the POSITA would have enjoyed a reasonable expectation of success in doing so, at least because Baarman-267 and Veselic both utilize well-known electronic components, such as batteries and microcontrollers, in analogous ways; and because Veselic provides specific guidance, including timing diagrams, flow charts, and schematics, for how to implement its teachings using such components. (EX1013, 1:4-8, 13:15-26, Figs. 4-8.)

(ii) First and second voltage detectors

344. Veselic teaches a voltage sensing circuit 30 that detects a voltage drop across a battery charge controller 20:

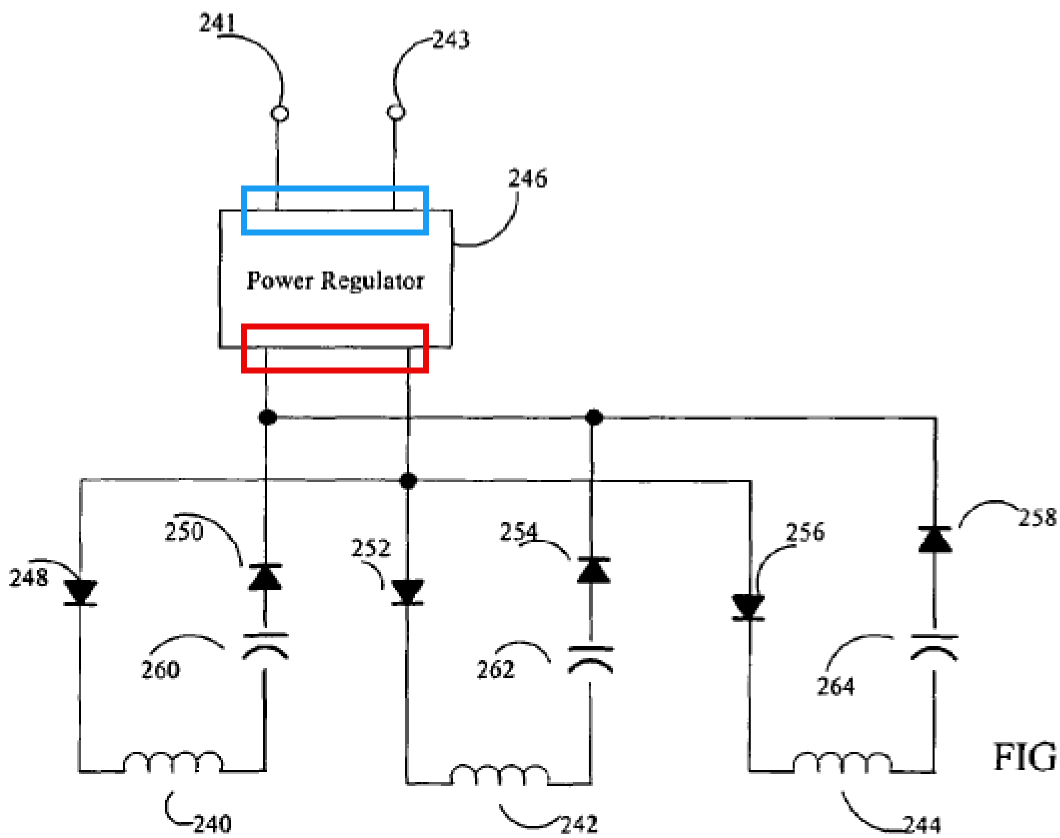
FIG. 4



(EX1013, 5:30-64, Figs. 4 (annotated), 6, 8.)

345. Veselic teaches first and second voltage detectors at least because the voltage sensing circuit 30 "compar[es] the voltage at the input and output of the battery charge controller 20". (EX1013, 5:55-64, Figs. 4, 6, 8.) That is, a first voltage detector detects the input voltage at the front end of the controller; and a second voltage detector detects the output voltage at the rear end of the controller. (*Id.*) In combination with Baarman-267, the first voltage detector would detect the input voltage at the front end of power regulator 246 (highlighted in red below);

the second voltage detector would detect the output voltage at the rear end of power regulator 246 (blue):



(EX1014, Fig. 7 (annotated).)

(iii) Microprocessor monitoring the detected voltages

346. Baarman-267 discloses that the voltage and current output of power regulator 48 is controlled by adapter controller 38, which can be "a microprocessor in association with a microcontroller." (EX1014, 4:37-44.) Similarly, Veselic discloses implementing its circuit using "programmable devices such as digital signal processors (DSPs) [and] micro-controllers," which the POSITA would

understand to include a microprocessor. (EX1013, 13:15-22.) Accordingly, the POSITA would have implemented adapter controller 38 with a microprocessor to monitor the detected voltages, as described above.

(iv) Transmitting a monitoring result to the charging device

347. Adapter controller 38 wirelessly communicates with CPS transceiver 36 of CPS 10 via adapter transceiver 44:

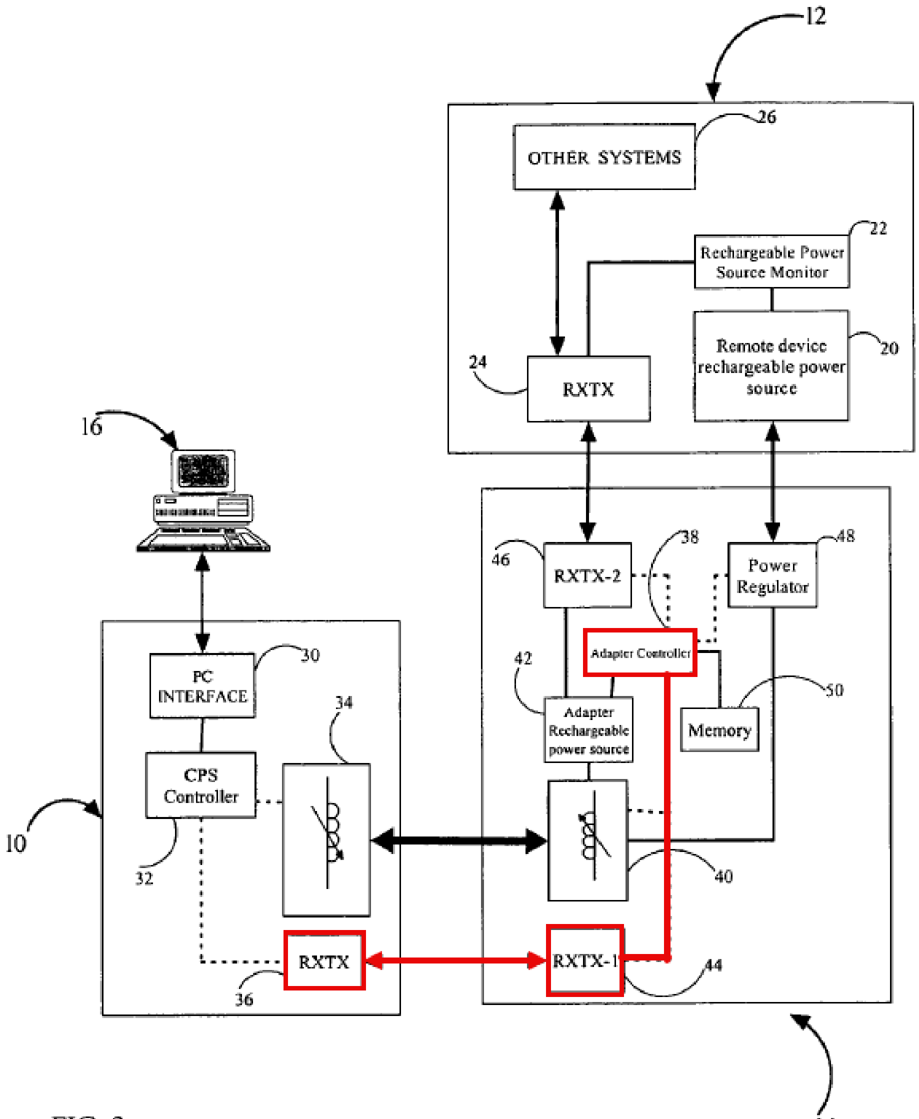


FIG. 3

(EX1014, 4:16-28, Fig. 3 (annotated).)

348. The communication is wireless at least because adapter transceiver 44 and CPS transceiver 36 communicate wirelessly; for example, Baarman-267 discloses that adapter transceiver 44 may be a wireless RFID device; and that CPS

transceiver 36 can include an antenna for wireless communication. (EX1014, 3:45-51, 4:16-20.)

349. Baarman-267 teaches that adapter controller 38 wirelessly communicates with the CPS 10 in order to provide charging information, such as voltage and current requirements, which CPS 10 uses to configure the battery charging. (EX1014, 4:65-5:9, Fig. 4.) Baarman-267 further teaches, via its incorporation of Baarman-499, that signals received by CPS 10 can be used to induce a change in intensity of the magnetic field generated by the primary coil of the power interface 34, in a manner analogous to that described in Ground 1 for Baarman-878. (EX1008, 11-15, Figs. 4, 5A-5B.) For example, a controller of CPS 10 can manipulate the rail voltage of a power source, thereby changing the amplitude of an inverter that supplies AC power to the primary coil. (*Id*.) The POSITA would thus understand that changing the inverter amplitude will accordingly change the amplitude of the AC power; and thus the intensity of the magnetic field induced at the primary coil, by the Biot-Savart Law and Faraday's Law. (*See* EX1017, 589-601, 780-89.)

350. To the extent not expressly disclosed, it would have been obvious to combine Baarman-267 and Veselic such that adapter controller 38 would use the wireless connection to transmit a feedback signal to CPS 10, based on a result of the monitoring of the detected voltages, to lower the AC current. Veselic teaches

that measuring the difference between the first and second voltages "allows the total power consumption of the circuit to be inferred," *i.e.*, as the product of the voltage drop and the current. (EX1013, 5:43-54.) Veselic would thus permit Baarman-267 to determine whether power consumption exceeds a maximum permissible limit; and to lower the current accordingly. As described above, adapter controller 38 wirelessly transmits signals to CPS 10, in order to control the current and voltage of the power regulator 48. The POSITA would have utilized adapter controller 38 to transmit a monitoring result—*e.g.*, an instruction to lower the rail voltage, thus reducing the AC current provided to the primary winding (and thus induced in the secondary winding), in response to a determination that power consumption is too high—to the power supply, in order to stay within the limits of a current-limited power source, such as a computer USB port.

f. Element [E]

351. This element is met based on Baarman-267. As described above for element [D], the monitoring result includes a wireless feedback control signal transmitted via adapter transceiver 44, which adjusts a power applied to the primary winding of CPS power interface 34 and induces a change of intensity of the magnetic field.

352. Inducing the change of intensity is based on relative positions of the CPS 10 and the adapter 14. As described above, CPS 10 includes a primary

winding of CPS power interface 34, and adapter 14 includes a secondary winding of adapter power interface 40. The POSITA would understand that, by Faraday's Law, as the adapter 14 and the CPS 10 become closer, the magnetic flux of the secondary winding increases, and the induced current in the secondary winding becomes greater (and vice versa). (EX1017, 784-85.) Thus, bringing adapter 14 toward CPS 10 closer can increase the induced signal and result in an overvoltage condition (*e.g.*, the first voltage and/or second voltage exceeding a maximum voltage), prompting the monitoring result and power supply adjustment signal as described above. This sequence is analogous to the "prior art" charging method described in the '568 patent. (EX1001, 2:21-32.) Further, it is analogous to the patent owner's explanation of specification support for this limitation, as described for Ground 1, claim 1[E][(i).

3. Claim 3

353. Claim 3 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

354. The preamble is met as described above for claim 1.

b. Element [A]

355. This element is met as for claim 1[D]. For example, Baarman-267 discloses that adapter transceiver 44 may be a wireless RFID device; and that CPS

transceiver 36 can include an antenna for wireless communication. (EX1014, 3:45-51, 4:16-20.)

c. Element [B]

356. This element is met as for claim 1[D]. For example, Veselic discloses a voltage comparator as described for Ground 2, claim 3[B].

d. Element [C]

357. This element is met as described for claim 1[D].

4. Claim 7

358. Claim 7 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

359. The preamble is met at least by adapter 14 as described for claim 1.

b. Element [A]

360. This element is met as for claim 1[A].

c. Element [B]

361. This element is met as for claim 1[B].

d. Element [C]

362. This element is met as for claim 1[C].

e. Element [D]

363. This element is met as for claim 1[D].

f. Element [E]

364. This element is met as for claim 1[E].

5. Claim 8

365. Claim 8 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

366. The preamble is met as described above for claim 7.

b. Element [A]

367. This element is met as for claim 1[A]. Magnetic flux of the magnetic field generated from primary coil 34 is inductively linked to secondary coils 202, 204, 206 by Faraday's Law. (*See* EX1017, 780-89.)

6. Claim 9

368. Claim 9 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

369. The preamble is met as described above for claim 7.

b. [A]

370. This element is met as for claim 3[A].

c. Element [B]

371. This element is met as for claim 1[D].

d. Element [C]

372. This element is met as for claim 3[B].

e. Element [D]

373. This element is met as for claim 3[C].

7. Claim 11

374. Claim 11 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

375. The preamble is met as described above for claim 7.

b. Element [A]

376. This element is met as for claim 1[D]. For example, adapter controller 38 transmits a monitoring result to CPS 10 to, *e.g.*, request that CPS 10 decrease the rail voltage of its internal power source. (EX1008, 11-15, Figs. 4, 5A-5B.)

8. Claim 12

377. Claim 12 is met based on Baarman-267 in view of Veselic.

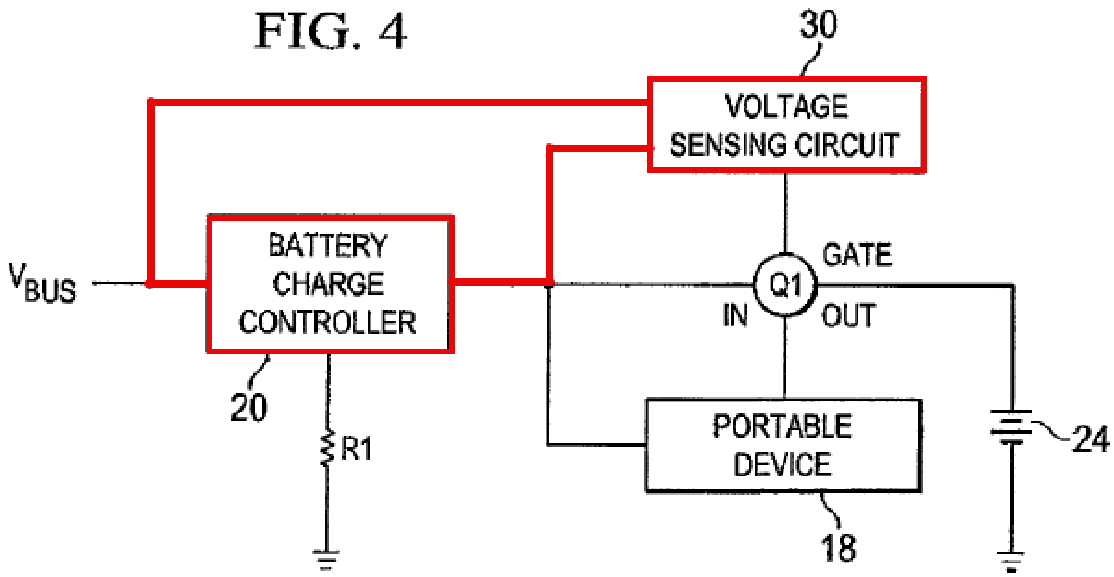
a. [Preamble]

378. The preamble is met as described above for claim 7.

b. Element [A]

379. This element is met as for claim 1[C] and [D]. For example, adapter controller 38 transmits a result of monitoring a voltage drop (difference of voltages) between the front and rear ends of the CCCV supply, as taught by Veselic:

FIG. 4



(EX1013, 5:30-64, Figs. 4 (annotated), 6, 8.)

9. Claim 30

380. Claim 30 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

381. The preamble is met as described above for claim 7.

b. Element [A]

382. This element is met as for claim 1[C] and [D]. For example, adapter controller 38 includes a microprocessor. (EX1014, 4:37-44.)

10. Claim 31

383. Claim 31 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

384. The preamble is met as described above for claim 7.

b. Element [A]

385. This element is met as for claim 1[C], and [D]. As described for 1[D], adapter controller 38 can use wireless feedback control to manipulate the rail voltage of CPS 10's internal power source, thereby changing the amplitude of the AC power provided to primary coil 34—and, thus, the amplitude of the induced AC current at secondary coils 202, 204, 206. This accordingly changes the input provided to the front end of power regulator 48, and the output of the power regulator 48 as described in 1[D] and Fig. 5 of Veselic. (EX1013, Fig. 5.)

11. Claim 32

386. Claim 32 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

387. The preamble is met as described above for claim 7.

b. Element [A]

388. This element is met as for claim 1[B] and [C].

12. Claim 33

389. Claim 33 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

390. The preamble is met as described above for claim 7.

b. Element [A]

391. This element is met as for claim 1[C] and [D]. For example, Veselic discloses charging the battery in an initial constant-current phase, followed by a constant-voltage phase:

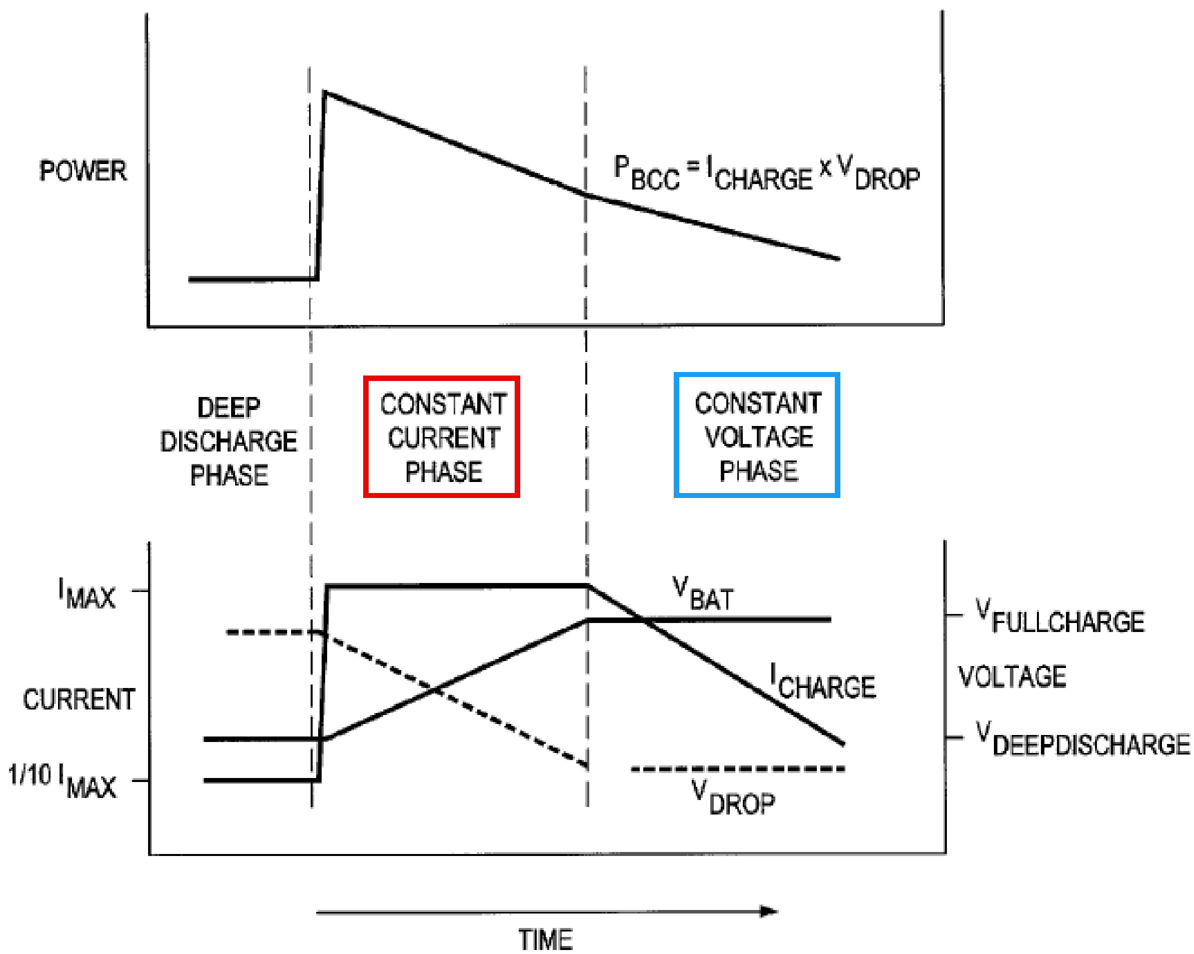


FIG. 5

(EX1013, 6:58-7:14, Fig. 5 (annotated).)

13. Claim 34

392. Claim 34 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

393. The preamble is met as described above for claim 7.

b. Element [A]

394. This element is met as for claim 1[C] and [D]. For example, Veselic discloses that once the battery voltage (V_{BAT}) reaches a threshold level ($V_{FULLCHARGE}$), charging power is provided in a constant voltage phase:

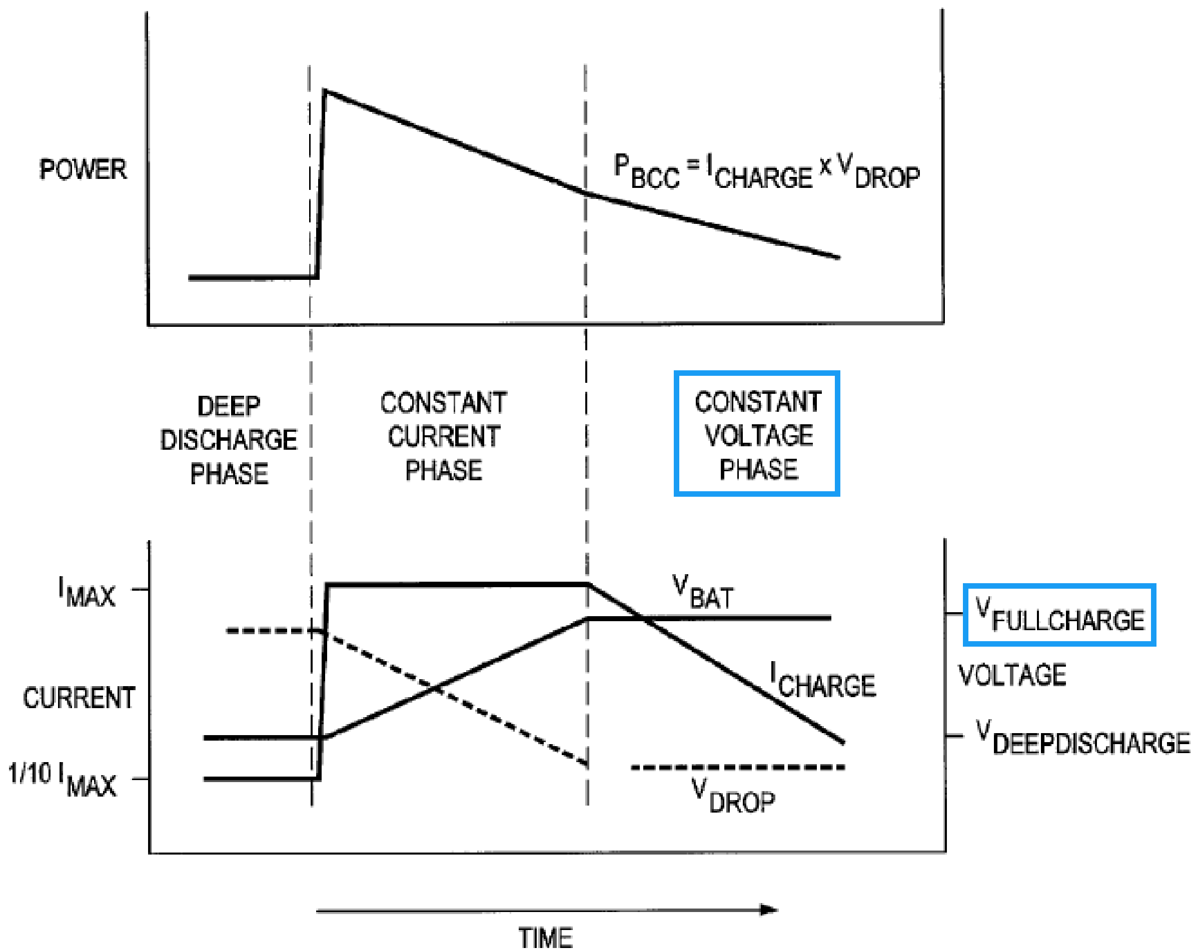


FIG. 5

(EX1013, 6:58-7:14, Fig. 5 (annotated).)

14. Claim 48

395. Claim 48 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

396. The preamble is met as for claim 7[Preamble].

b. Element [A]

397. This element is met as for claim 1[A].

c. Element [B]

398. This element is met as for claim 1[B].

d. Element [C]

399. This element is met as for claim 1[C] and claim 33[A].

e. Element [D]

400. This element is met as for claim 1[D].

f. Element [E]

401. This element is met as for claim 1[D] and [E].

15. Claim 49

402. Claim 49 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

403. The preamble is met as described above for claim 48.

b. Element [A]

404. This element is met as for claim 8[A].

16. Claim 50

405. Claim 50 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

406. The preamble is met as described above for claim 48.

b. Element [A]

407. This element is met as for claim 3[A].

c. Element [B]

408. This element is met as for claim 3[B].

d. Element [C]

409. This element is met as for claim 3[C].

e. Element [D]

410. This element is met as for claim 3[A] and [C].

17. Claim 52

411. Claim 52 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

412. The preamble is met as described above for claim 48.

b. Element [A]

413. This element is met as for claim 11[A].

18. Claim 53

414. Claim 53 is met based on Baarman-267 in view of Veselic.

a. [Preamble]

415. The preamble is met as described above for claim 48.

b. Element [A]

416. This element is met as for claim 12[A].

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Executed the 12th of June, 2025 in Seattle, Washington.

Respectfully submitted,

Joshua R. Smith