UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner,

v.

VAMPIRE LABS, LLC.
Patent Owner.

Patent No. 8,358,103

Inter Partes Review No. IPR2025-01215

DECLARATION OF MICHAEL S. CHEN

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I, Michael S. Chen, 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. 8,358,103 (EX1001), issued January 22, 2023 (the "'103 patent"). I understand that Vampire Labs, LLC. ("Patent Owner" or "Vampire") states that it is the owner of the '103 Patent.

2. I have reviewed and am familiar with the '103 patent. I understand that the '103 patent includes 14 claims, of which claims 1, 11, and 14 are independent. I also understand that the Petition for *inter partes* review that accompanies this Declaration (the "Petition") seeks to cancel claims 1-14 (the "challenged claims") of the '103 patent.

3. In preparation for this Declaration, I reviewed the exhibits provided by the Petitioner, including the '103 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 an engineer, professor, and consultant.

4. The ’103 patent is generally directed to battery charger circuits, such as for wireless inductive battery charging for devices such as mobile phones. (EX1001, Abstract, 1:19-22.) I am familiar with the technology described in the ’103 patent both as of its earliest possible priority date of July 4, 2008, and its actual U.S. filing date of June 29, 2009.

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 ’103 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. 5,734,254 to Stephens (“Stephens”)	Stephens (EX1009)
P. HOROWITZ AND W. HILL, THE ART OF ELECTRONICS (Cambridge Univ. Press 2nd Ed. 1989)	Horowitz (EX1010)
U.S. Patent Appl. Pub. No. 2008/0061733 to Toya (“Toya”)	Toya (EX1011)

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 $700 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 Los Angeles, California, USA.

II. SUMMARY OF GROUNDS

9. I understand that the Petition for *inter partes* review of the '103 patent asserts the following grounds of unpatentability:

Ground	35 U.S.C. §	Claims	Prior Art References
1	103	1-6, 8, 9, 11-14	Stephens, Horowitz
2	103	1, 2, 9-11	Toya, Horowitz
3	103	3-7, 12-14	Toya, Stephens, Horowitz

III. QUALIFICATIONS AND EXPERTISE

10. I am a tenured full professor of Electrical Engineering at the University of Southern California, where I have been a faculty member since 2011. As a professor, I research and teach electrical circuit design. My research focuses on analog mixed-signal and RF circuit architectures for data converters (both ADC and DAC), clock generation (such as PLL and DLL), digital VLSI, SoC, mostly-digital circuits, artificial intelligence (AI) and machine learning (ML) accelerators, analog CAD, and power amplification (PA). My research has been applied to

wireless, wireline communications, computing, IoT systems, autonomous vehicles, etc.

11. I earned my Ph.D. and M.Sc. in Electrical Engineering and Computer Science from the University of California, Berkeley in 2006 and 2002 respectively. I received my B.S. degree from National Taiwan University, where I graduated as the top student in the upper division.

12. My work has been recognized by both academic and commercial entities. I have published over 90 conference, journal, magazine articles, including multiple publications in the IEEE International Solid State Circuits Conference (ISSCC), IEEE Symposium on VLSI Circuits (VLSIC), IEEE Custom Integrated Circuits Conference (CICC), IEEE European Conference on Solid-State Circuit (ESSCIRC), IEEE Radio Frequency Integrated Circuits Symposium (RFIC), IEEE Journal of Solid-State Circuits (JSSC), and Transactions on Circuit and System I (TCAS-I). My research has been funded by the National Science Foundation (NSF), ONR, IARPA, SRC, DARPA and various industry companies. I have also served as a technical consultant for companies including Qualcomm, Tetramem, BAE Systems and Samsung.

13. I have received recognition for my work and research. In 2024, I was honored with the grade of IEEE Fellow to recognize my technical contributions in solid-state circuit society. This grade is reserved for 0.1% of IEEE members. In

2023, I was the co-recipient of the ISSCC Jack Kilby Award for significant advances in analog mixed-signal circuits. In 2022, I was a co-recipient for the RFIC 2022 Best Student Paper Award for my work with students in my laboratory on a circuit prototype. From 2021 to 2023, I was the IEEE Solid-State Circuit Society (SSCS) Distinguished Lecturer. I have been invited to offer seminars, workshops, keynote talks, and panel discussions in major IEEE conferences, IEEE SSCS chapters, and universities on a range of topics covering fundamental to advanced integrated circuit design and how to improve the performance and/or reduce cost of a circuit or system. In 2019, I was also the recipient of Qualcomm Faculty Award, and in 2014 both the NSF Faculty Early Career Development (CAREER) Award and DARPA Young Faculty Award (YFA). As a student, I was the recipient of a UC Regents' Fellowship at Berkeley in 2000 and the Analog Devices Outstanding Student Award for IC design in 2006.

14. I have extensive experience and familiarity with power management circuitry and various wireless communication circuits, where transformer and inductive coupling is extensively used in my previous designs. Most of my past and ongoing research and industry projects have incorporated power management block to supply proper voltage for circuit operation. I have also served in various review panels (e.g. NSF panels, IEEE conferences and journals), reviewing research papers on inductive charging circuitry. In addition, I have been teaching

various circuit courses at USC, and power management/transformer/wireless communication circuit are common circuit examples that I use to show my students how various related components can be designed and implemented.

15. My qualification are further detailed in my curriculum vitae, which is provided as Exhibit 1008.

IV. LEGAL UNDERSTANDING

A. My Understanding of Claim Construction

16. 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 '103 patent as of the priority date (as discussed below), and in light of its specification and file history (including the file history of the *ex parte* reexamination).

B. My Understanding of Obviousness

17. 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 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.

18. 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.

19. 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.

20. 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 ’103 PATENT

A. Background Of The ’103 Patent

21. The ’103 patent relates to battery chargers for devices such as mobile phones. As described by the patent, charging devices may suffer from “vampiric” power consumption that can occur while the charging unit (*e.g.*, an inductive charging unit) is coupled to an alternating current (AC) power source. (EX1001, 1:26-62.) The patent purports to limit vampiric power consumption by automatically coupling the charging unit and the AC power source to charge a battery when the battery is below a charging threshold, and then decoupling them once a desired charging state is observed. (EX1001, 1:26-62, 2:67-3:51.)

B. Priority Date of the Challenged Claims

22. I understand the application that became the ’103 patent (Appl. No. 12/511,069) was filed on July 29, 2009 as a continuation-in-part of Appl. No. 12/497,859, which was filed on July 6, 2009. (EX1001, (22), (63).) I further understand that Appl. No. 12/511,069 claims priority to a provisional application

(No. 61/078,365) filed on July 4, 2008, and to a second provisional application (No. 61/084,616) filed on July 29, 2008. (EX1001, (60).)

23. It is my view that Appl. No. 12/511,069 introduced and claimed new matter that is not found in any of the other applications in the chain of priority (EX1003, EX1004, EX1005, and EX1006). For example, all challenged claims of the '103 patent require a monitoring module to determine when a target device battery is below a charging threshold *while using power from a supplemental power source*. However, neither the provisional applications nor the parent application supported any such supplemental power source, or any determining when a target device battery is below a charging threshold while using power from such a supplemental power source. Instead, it was only with the filing of the 12/511,069 application on July 29, 2009, that the applicant for the first time provided any disclosure relating to a supplemental power source or determining when a target device battery is below a charging threshold while using power from such a supplemental power source. (*Id.*; EX1002, 83.) Similarly, certain challenged claims include additional limitations that were not disclosed until the July 29, 2009 application, including the "USB module" of claim 7, and the "opto-coupled relay" of claims 11 and 14. (*See* EX1002, 82, 83.) I understand that, based on the disclosures of the '103 patent and the applications in its priority chain, and based further on the nature and scope of the claims, and the existing

knowledge in the field, the challenged claims are thus not entitled to a priority date earlier than July 29, 2009.

24. In any event, under no circumstances is the ’103 patent entitled to a priority date earlier than July 4, 2008. This is the filing date of the earliest application to which the ’103 patent claims priority.

25. In rendering my opinions, I have assumed a priority date of July 29, 2009. As stated above, this is the earliest priority date to which the ’103 patent is entitled. However, my opinions would not change in any way even if the ’103 patent were afforded a priority date of July 4, 2008.

C. Prosecution History Of The ’103 Patent

26. I understand that the application that became the ’103 patent was filed on July 29, 2009, and was allowed following only a single Office Action, which rejected the claims in view of the prior art. (EX1002, 39-51.) I understand that the Patent Office did not consider any of the prior art references discussed herein.

D. Level of Ordinary Skill

27. 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, based on

the disclosure of the ’103 patent and an assumed priority date of July 29, 2009[1], a person of ordinary skill in the art (“POSITA”) would have had a Bachelors degree and a Masters degree in Electrical Engineering, Computer Engineering, Physics, or an equivalent field, as well as one to two years of academic or industry experience in power electronics or battery charging or comparable industry experience.

E. Claim Construction

28. 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 ’103 patent as of July 29, 2009, and in light of its specification and file history.

29. 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.

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[1] Even if a priority date of July 4, 2008, were applied, it would not change the level of ordinary skill, or any of my analysis herein.

30. Claims 1-10 and 14 recite a "connection module"; a "monitoring module"; an "activation module"; and a "separation module." (EX1001, 18:33-20:49.) Further, claim 5 recites an "interrupt controller module," and claim 7 recites a "USB module." I have been asked to consider, and discuss herein, whether these limitations would be met in the event that one or more of these limitations are construed as means-plus-function limitations according to 35 U.S.C. § 112(f). The following table provides what I understand to be the respective functions and corresponding structures for each such limitation in the table below.

Claim Term	**Function**	**Structure**
connection module (claims 1-10, 14)	Claims 1-10: Determining when a target device is coupled to an inductive power apparatus (EX1001, 18:34-35) Claim 14: Confirming whether a target device is coupled to an inductive power apparatus (EX1001, 20:23-24)	Connection module 1118, and equivalents thereof (EX1001, 11:55-57, 12:9-19, Fig. 11)

Claim Term	Function	Structure
monitoring module (claims 1-10, 14)	Claims 1-10: Determining when a target device battery is below a charging threshold while using power from a supplemental power source (EX1001, 18:35-38) Claim 14: Detecting whether a target device battery is below a charging threshold while using power from a supplemental power source (EX1001, 20:32-34)	Monitoring module 920 and equivalents thereof (EX1001, 11:1-5, 16:13-24)
activation module (claims 1-10, 14)	Claims 1-10: Automatically coupling the inductive power apparatus and an alternating current power source when a power level of the target device battery is below the charging threshold (EX1001, 18:39-42) Claim 14: Automatically coupling the target device and the alternating current power source using the inductive power apparatus when the target device battery is below the charging threshold (EX1001, 20:41-44)	Activation module 922 and equivalents thereof (EX1001, 3:50-51, 7:55-8:5, 8:22-29, 10:50-55, 17:5-9, Figs. 4, 11)

Claim Term	Function	Structure
separation module (claims 1-10, 14)	Claims 1-10: Automatically decoupling the inductive power apparatus and the alternating current power source when a desired charging state of the target device battery is observed (EX1001, 18:43-46) Claim 14: Automatically decoupling the target device and the alternating current power source when a desired charging state of the target device battery is detected by the monitoring module (EX1001, 20:45-48)	Separation module 334 and equivalents thereof (EX1001, 7:55-8:5, 8:22-29, 10:50-55, Figs. 4, 11)
interrupt controller module (claim 5)	Generating an interrupt signal determined by the feedback signal received by the input buffer (EX1001, 19:9-11)	Interrupt controller module 1042 and equivalents thereof (EX1001, 10:22-24, 11:13-16)
USB module (claim 7)	Generating an engage signal to control the coupling state of the inductive power apparatus and the alternating current power source (EX1001, 19:19-21)	USB module 1052 and equivalents thereof (EX1001, 10:24-30, 13:21-40, Fig. 12)

VI. TECHNICAL ANALYSIS OF THE PRIOR ART

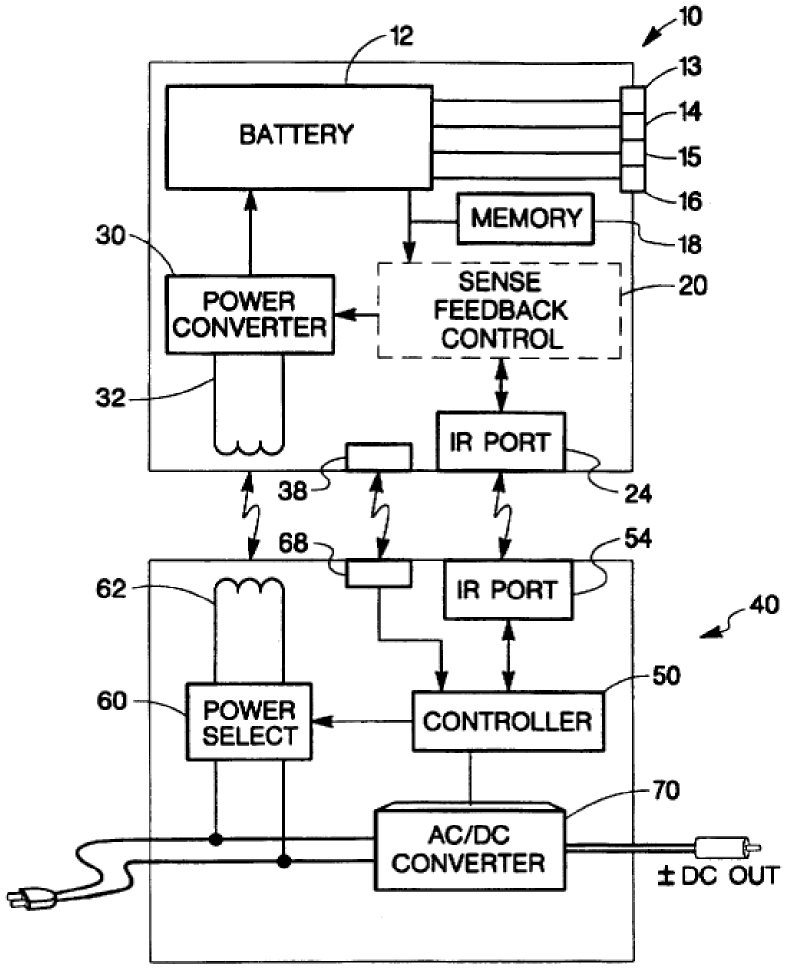
A. Ground 1: Claims 1-6, 8, 9, and 11-14 are Rendered Obvious by Stephens in View of Horowitz

31. It is my view that Stephens in view of Horowitz teaches each and every limitation of claims 1-6, 8, 9, and 11-14 of the ’103 patent, for the reasons set forth below.

1. Summary of Stephens

32. Stephens is a U.S. Patent issued to inventor Charles S. Stephens. The underlying application was filed on December 6, 1996, and issued as U.S. Patent No. 5,734,254 on March 31, 1998. I understand Stephens is thus prior art to the ’103 patent under at least 35 U.S.C. §§102(a), (b), and (e).

33. Stephens discloses battery packs, AC adapters, and charging systems for portable electronic devices, such as cell phones. (EX1009, 1:6-8.) Figure 1 illustrates:



(EX1009, Fig. 1, 2:47-4:21.)

34. In embodiments, a battery charging system includes an adapter (40) and a battery pack (10) with a battery (12). (EX1009, 1:64-2:19, 3:59-4:14.) A proximity indicating device (38) of the battery pack indicates that the battery pack is positioned for charging. (EX1009, 3:50-58.) The adapter comprises a primary transformer winding (62) that emits an AC power signal controlled by a power selector (60). (EX1009, 1:64-2:19, 3:59-4:14.) The AC power signal is inductively coupled to a secondary transformer winding (32) of the battery pack,

which is used to charge the battery via a power converter (30). (EX1009, 1:64-2:19, 3:8-41.) The adapter includes a controller 50, which may be an Intel 8051 microprocessor. (EX1009, 3:59-4:6.)

35. Stephens is analogous art to the claimed invention because it is directed to the same field of endeavor—electronic circuits, including for battery charging. For example, Stephens' disclosure of battery packs, AC adapters, and charging systems is analogous to disclosures in the '103 patent of device batteries, AC current power sources, and battery charging systems. (EX1009, 1:6-8; EX1001, Abstract, Fig. 9.) Further, Stephens discloses that its systems are for portable electronic devices, such as cell phones—analogous to those of the '103 patent. (EX1009, 1:6-8; EX1001, 5:27-29.) And by disclosing battery chargers that flexibly "permit[] a battery of any size and voltage to be charged," Stephens is reasonably pertinent to the problem faced by the '103 patent inventor—providing battery charging systems that couple a power source and an inductive power apparatus to charge a device battery. (EX1009, 1:5-42; EX1001, 1:19-39.)

2. Summary of Horowitz

36. Horowitz is an electronics textbook authored by Harvard faculty and published in 1989, setting forth a "definitive volume teaching the art of the subject." (EX1010, *xix*.) I understand Horowitz is prior art to the '103 patent under at least 35 U.S.C. §§102(a) and (b).

37. Relevant to this proceeding, Horowitz includes, in a chapter titled "Foundations," disclosure of switches ("mundane but important devices [that] seem to wind up in most electronic equipment"), including relay switches. (EX1010, 53-55.) Horowitz further discloses, in a chapter titled "Digital Meets Analog," the use of opto-coupler relays, including examples of "nearly every kind of opto-coupler you are likely to encounter." (EX1010, 595-99.) Horowitz provides specific instructions, including schematics and instrumentation diagrams, for implementing opto-coupler relays into practical systems. (EX1010, 595-99.)

38. 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 '103 patent, setting forth a "definitive volume teaching the art of the subject"; and provides disclosures analogous to those of the '103 patent. (EX1010, *xix*.) For example, Horowitz includes specific chapters and passages relating to power supply circuits, batteries, and switching components such as relays— analogous to the '103 patent's disclosure of an inductive battery charging system that utilizes relays to couple and decouple a power source and an inductive power apparatus. (*See, e.g.*, EX1010, 44-55, 307-84, 920-38; EX1001, 4:36-5:2, 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 '103 patent. (*Id.*)

3. Claim 1

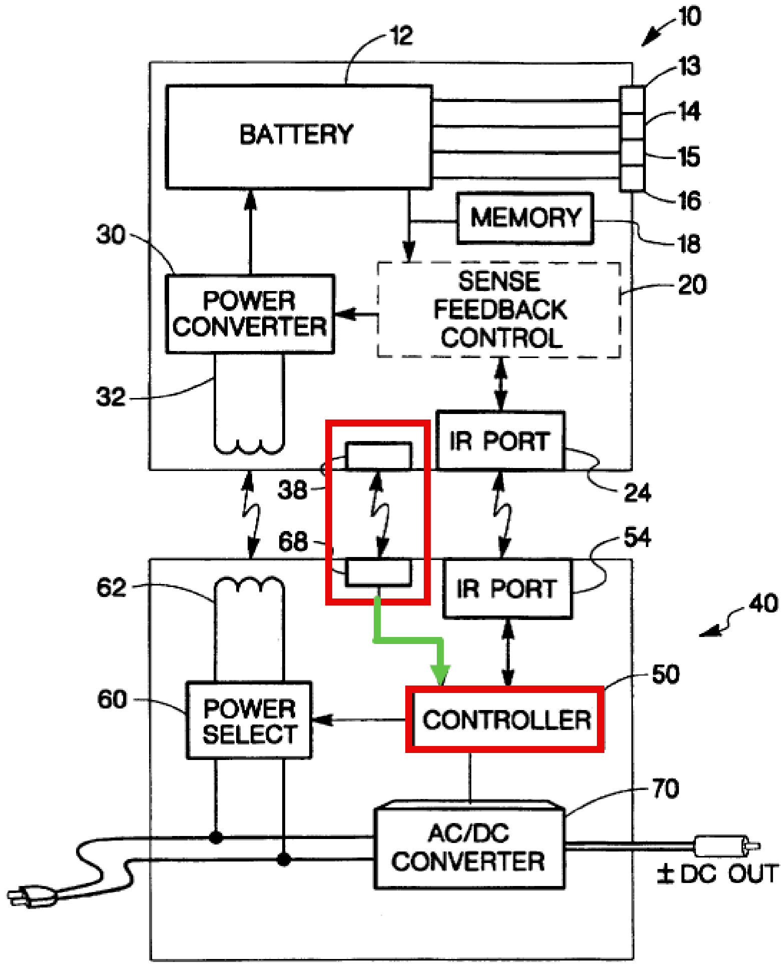
39. Stephens in view of Horowitz meets each limitation of claim 1, as described below.

a. [Preamble] *An inductive battery charging system, comprising:*

40. Stephens in view of Horowitz meets the preamble. For example, Stephens' "object" is to "provide a battery and corresponding charger." (EX1009, 1:40-42.) The battery charging system is inductive: for example, in the charging system, an AC adapter is configured for "*inductively* charging another battery pack or portable electronic device." (EX1009, 1:64-2:19 (emphasis added).)

b. [A] *a connection module to determine when a target device is coupled to an inductive power apparatus;*

41. Stephens in view of Horowitz meets this element. For example, Stephens discloses that proximity indicating device 38 (of battery pack 10, *i.e.*, the target device) and proximity detector 68 (of adapter 40) indicate via signals to controller 50 that the battery pack is proximate to the adapter and "positioned for charging" via inductive coupling of the transformer windings (32, 62). (EX1009, 2:8-19, 3:50-58, Fig. 1.) Figure 1 illustrates:



(EX1009, Fig. 1 (annotated).)

42. The claimed connection module is thus met by controller 50 in communication with proximity indicating device 38 and proximity detector 68.

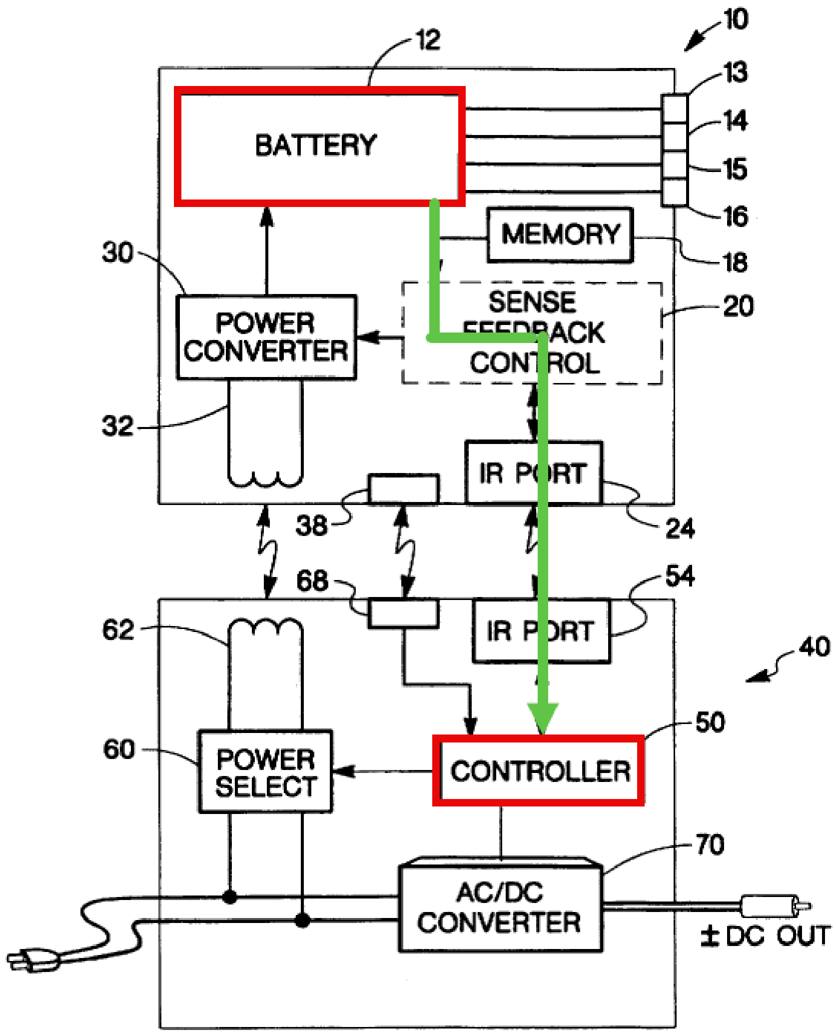
43. The primary transformer winding 62 of adapter 40 becomes "inductively coupled to secondary transformer winding 32," thus "form[ing] a complete transformer." (EX1009, 4:10-14.) Primary transformer winding 62, and/or the "complete transformer" formed with secondary transformer winding 32, meet the claimed inductive power apparatus.

(i) Means-Plus-Function

44. If *connection module* is interpreted as a means-plus-function limitation, this element is still met by Stephens in view of Horowitz. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. And as described below for claim 5, element [B], controller 50 is preferably an Intel 8051 processor that includes an input buffer, at least via general purpose I/O ports used for input and output signals (*e.g.*, from proximity detector 68). (EX1001, 12:20-22, 14:60-64; EX1012, 1-3.) Further, controller 50 can include "sensing, feedback and control logic". (EX1009, 3:8-13, 3:20-26, 3:63-67.) For the purposes of this proceeding, this is equivalent to the '103 patent's connection module comprising a sense feedback loop and an input buffer that identifies coupling and receives input indicative of the same. (EX1001, 11:55-57, 12:9-19, Fig. 10.) Thus, the corresponding structure is met.

c. [B] *a monitoring module to determine when a target device battery is below a charging threshold while using power from a supplemental power source; and*

45. Stephens in view of Horowitz meets this element. For example, Stephens discloses that "sensed battery conditions are propagated from battery 12 through IR port 24 to controller 50 in adapter 40." (EX1009, 3:65-67.) Figure 1 (annotated below) illustrates:



(EX1009, Fig. 1 (annotated).)

46. The claimed monitoring module is thus met by controller 50 in communication with battery 12 via IR ports 24, 54. The sensed conditions include a "threshold voltage," *e.g.*, a full charge threshold, below which the battery may be "normally charged"; and at which charging may be discontinued. (EX1009, 2:52-57, 2:64-67, 3:1-7, 3:14-33, 3:63-4:6.)

47. The supplemental power source is met at least by battery 12 itself. This is consistent with the '103 patent. For example, claim 9, which depends from claim 1, recites that the supplemental power source is comprised of "*at least one of a target device battery*, a charger system battery and an alternate inductive power apparatus." (EX1001, 19:27-30 (emphasis added), 2:51-53.) Thus a supplemental power source comprising a target device battery, such as Stephens' battery 12, is within the scope of the supplemental power source of the parent claim 1.

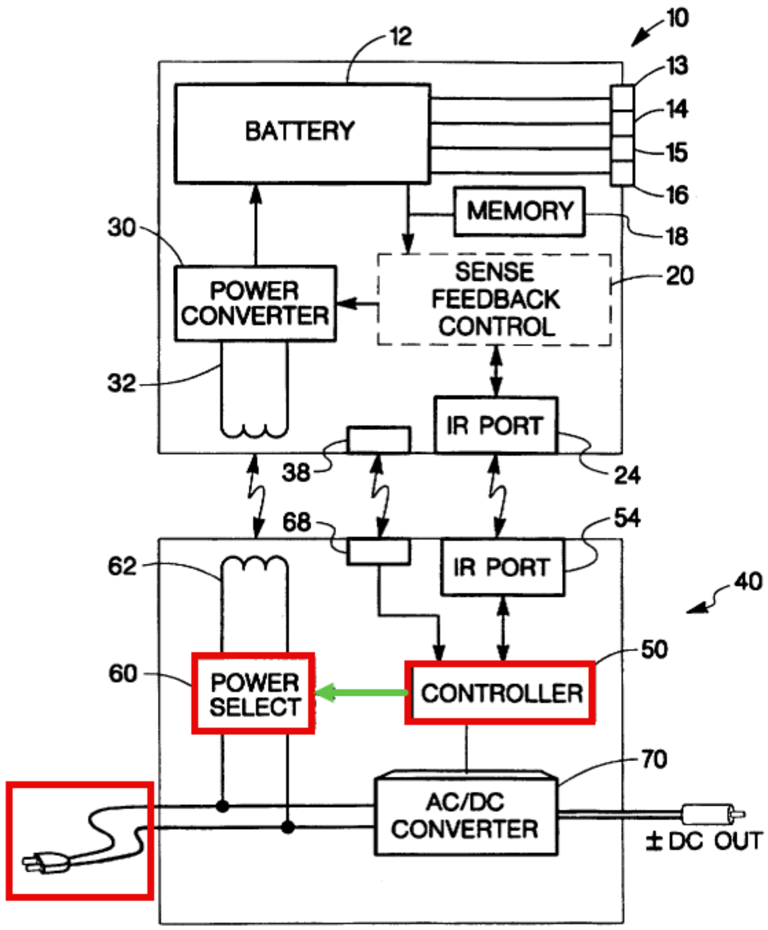
(i) Means-Plus-Function

48. If *monitoring module* is interpreted as a means-plus-function limitation, this element is still met by Stephens in view of Horowitz. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. Controller 50 is preferably an Intel 8051 processor, and as described above, is configured to receive "sensed battery conditions [that] are propagated from battery 12 through IR port 24." (EX1009, 3:59-67.) For the purposes of this proceeding, this is equivalent to the '103 patent's disclosure that a processor and a battery monitor of the monitoring module are coupled to the target device to evaluate the target device's battery level. (EX1001, 11:1-5.) Further, the '103 patent discloses that the monitoring module can use the processor to check the status of a GPIO input port; this is equivalent to controller 50 in Stephens, in which an Intel 8051 processor utilizes its general purpose I/O ports for input signals (*e.g.*, the sensed battery

conditions received from IR port 24). (EX1001, 14:60-64; EX1012, 1-3.) Thus, the corresponding structure is met.

d. [C] *an activation module to automatically couple the inductive power apparatus and an alternating current power source when a power level of the target device battery is below the charging threshold;*

49. Stephens in view of Horowitz meets this element. In Stephens, controller 50 provides control signals to power selector 60, which is "coupled between the primary transformer winding [62] and an AC input," to control the coupling of the primary transformer winding and the AC input. (EX1009, 1:64-2:19, 3:14-23, 3:50-4:14, 6:22-25, Fig. 1.) Figure 1 illustrates:



(EX1009, Fig. 1 (annotated).)

50. Stephens discloses that the control signals can cause power converter 30 and/or power selector 60 to automatically "discontinue charging once a full charge is reached and sustained." (EX1009, 3:16-26, 1:64-2:13, 4:7-14.) Conversely, because the battery is "normally charged by a high power charge until [the] threshold voltage is reached," the POSITA would understand Stephens to likewise teach that the control signals would cause power converter 30 and/or power selector 60 to automatically charge the battery when the battery's power

level is below the full charge threshold. (EX1009, 3:1-26, 2:5-13, 4:7-14.) This is at least because POSITA would understand that once battery charging is "discontinue[d]," the battery's power level will dissipate (particularly if the battery pack is installed in a device such as a notebook computer or cellular telephone, *see* EX1009, 2:49-52), such that it would eventually deplete without being reconnected to the AC power source for recharging. (EX1009, 3:23-26.) The POSITA would understand this to defeat the purpose of Stephens' battery charging system, which is configured to "reach[] and sustain[]" a full charge for rechargeable batteries such as lithium-ion and nickel metal hydride batteries. (EX1009, 3:23-33.) Further, as Stephens indicates, the regulation of such batteries is known in the art. (EX1009, 3:31-33.) The POSITA thus would understand Stephens' charger to apply known techniques to couple the inductive apparatus to the battery pack and maintain its charge.

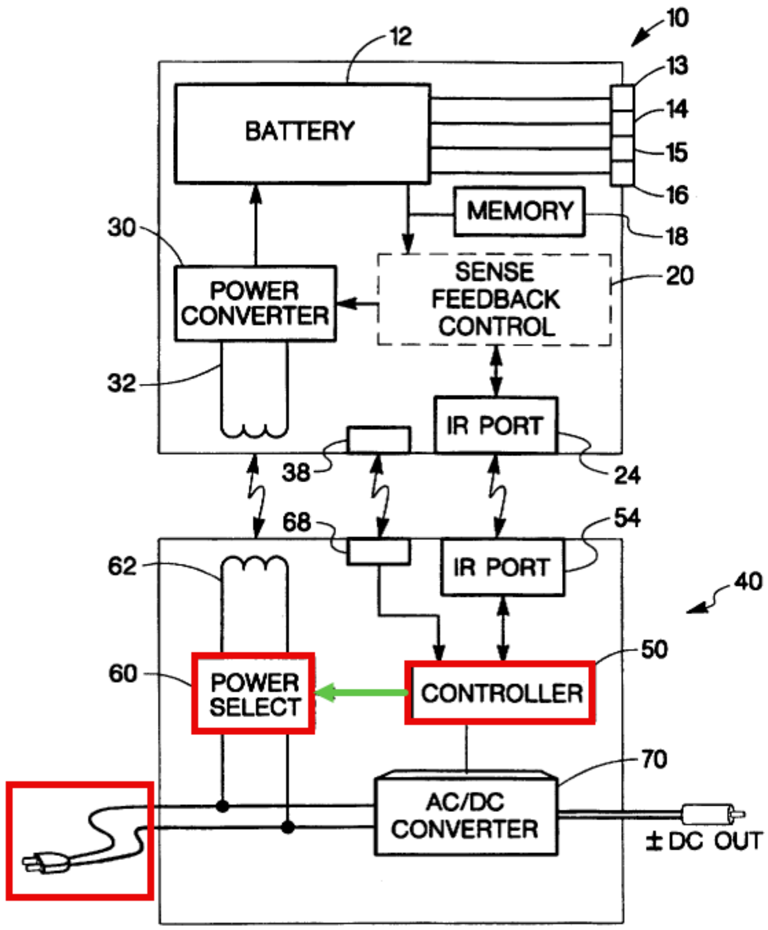
(i) Means-Plus-Function

51. If *activation module* is interpreted as a means-plus-function limitation, this element is still met by Stephens in view of Horowitz. (*See* ¶30.) The recited functions (*see* ¶30) are met as described above. With respect to structure, Stephens in view of Horowitz teaches that the power converter 30 and/or power selector 60 of the separation module comprises relay switches, such as decoupling relays, as described below for elements [D] and [E].) The '103 patent discloses that the

activation module uses a processor to control a relay of the separation module, *i.e.*, to couple or decouple the transformer 104 from the AC power source 102, as described above. (EX1001, 17:5-9.) This is met at least equivalently by controller 50, which is a processor that provides signals to power converter 30 and/or power selector 60 to control a relay, such that the battery is "normally charged by a high power charge until a threshold voltage is reached," after which charging may be discontinued. (EX1009, 3:1-4, 3:16-26.)

e. [D] ***a separation module to automatically decouple the inductive power apparatus and the alternating current power source when a desired charging state of the target device battery is observed,***

52. Stephens in view of Horowitz meets this element. As described above for element [C], Stephens discloses that the battery is "normally charged by a high power charge until a threshold voltage is reached," after which charging may be discontinued. (EX1009, 3:1-4, 3:16-26.) For example, "after a threshold voltage across battery 12 is sensed," controller 50 provides control signals to power selector 60, which is "coupled between the primary transformer winding [62] and an AC input." (EX1009, 1:64-2:19, 3:14-23, 3:50-4:14, 6:22-25, Fig. 1.) The control signals can cause power converter 30 and/or power selector 60 to automatically "discontinue charging once a full charge is reached and sustained." (EX1009, 3:16-26, 1:64-2:13, 4:7-14.) Figure 1 illustrates:



(EX1009, Fig. 1 (annotated).)

53. It would have been apparent to the POSITA that this discontinuing the charging could be performed by decoupling the primary transformer winding 62 and the AC input. For example, Stephens discloses that power converter 30 can include "decoupling relays." (EX1009, 3:34-40.) A relay is an electrically controlled switch, so the decoupling relays will decouple the terminals of the power converter 30. (EX1010, 55.)

54. To the extent not expressly disclosed in Stephens, it would have been obvious in view of Horowitz and/or Stephens itself for power selector 60 to similarly include decoupling relays, analogous to the decoupling relays of Stephens' power converter 30. Stephens explains that the power converter 30 and the power selector 60 can perform analogous functions; *i.e.*, either or both can "control the level of an AC power signal output." (EX1009, 2:8-13.) The POSITA would have further understood that by controlling the AC power signal output via power selector 60 instead of power converter 30, which belongs to the battery pack 10, the battery pack 10 could be made smaller and lighter by offloading components to the power selector 60 (of adapter 40)—a particular advantage for Stephens' lithium ion batteries, which, as Stephens recognizes, are known for advantageously being compact and lightweight. (EX1009, 2:60-67.) Additionally, as Stephens notes, providing components external to the battery pack 10 can advantageously allow a battery pack with "more universal application" that is "relatively inexpensive to manufacture." (EX1009, 4:2-6.)

(i) Motivation to Combine

55. While Stephens describes various "known configurations" of power converter 30 for controlling AC power signals, it does not provide similar detail for power selector 60. (EX1009, 3:34-40.) Accordingly, the POSITA would be

motivated to look to other teachings of how to implement AC power control in power selector 60.

56. The POSITA would naturally look to decoupling relays, because Stephens expressly describes their use in a different component of the same system to perform an analogous task (controlling AC power signals). (EX1009, 3:34-40.) The POSITA would also consult well-known and authoritative literature in the art, such as Horowitz, for guidance. This is particularly because Horowitz is a comprehensive and widely used textbook in the same field (electronics) as Stephens and the '103 patent, setting forth a "definitive volume teaching the art of the subject." (EX1010, *xix*.) For example, Horowitz includes specific passages guiding the POSITA's implementation of switching components such as relays. (EX1010, 55.)

57. Horowitz explains that a "primary use[]" of relays is for high-voltage or high-current switching. (EX1010, 55.) Horowitz describes specific advantages of relays: "relays are useful to switch ac power while keeping the control signals electrically isolated." (EX1010, 55.) This is analogous to the task performed by the power selector 60: "selecting a level of power emitted" from a high-voltage AC input (*e.g.*, 90-260 volts), based on control signals from controller 50. (EX1009, 1:64-2:13, 4:15-18.) The POSITA would thus be motivated to combine a relay, such as the decoupling relays of Stephens, with the power selector 60 to realize the

advantages described in Horowitz. Further, because decoupling relays are a "known configuration[]" and are already used in Stephens' battery charging system, the POSITA would have a reasonable expectation of success in making the combination. (EX1009, 3:34-40.)

(ii) Means-Plus-Function

58. If *separation module* is interpreted as a means-plus-function limitation, this element is still met by Stephens in view of Horowitz. (*See* ¶30.) The recited functions (*see* ¶30) are met as described above. As described above, Stephens in view of Horowitz teaches that the power converter 30 and/or power selector 60 comprises relay switches, such as decoupling relays; and that, as described in the '103 patent, the relay switches may include opto-coupled relays (as shown below for claim 11, element [F]) or electromechanical relays (such as described in Horowitz). (EX1001, 3:50-51; EX1010, 55, 595-98.) Further, in Stephens, the power converter 30 and/or power selector 60 receives signals from controller 50 that cause it to automatically "discontinue charging once a full charge is reached and sustained," *i.e.*, by decoupling the primary transformer winding 62 from AC power. (EX1009, 3:16-26, 1:64-2:13, 4:7-14.) For the purposes of this proceeding, this is equivalent to the '103 patent's disclosure that the separation module receives an output voltage of a comparator, which controls whether a relay

couples or decouples the transformer 104 from the AC power source 102. (EX1001, 7:55-8:5, 8:22-29, Fig. 9.)

f. [E] ***wherein the separation module is comprised of a relay switch,***

59. Stephens in view of Horowitz meets this element as described above for element [D]. For example, as described above, Stephens discloses "decoupling relays" and, at least in view of Horowitz, teaches that power selector 60 may include such a relay. The POSITA would understand decoupling relays to comprise a relay switch. (*See* EX1010, 55 ("Relays are electrically controlled switches.").)

g. [F] ***wherein the inductive power apparatus includes at least one of a transformer to inductively generate an electric current, a rectification circuit, and a voltage regulation circuit.***

60. Stephens in view of Horowitz meets this element. For example, the inductive power apparatus includes a transformer to inductively generate an electric current, at least because primary transformer winding 62 becomes "inductively coupled to secondary transformer winding 32" and thus inductively generates electric current to charge battery 12. (EX1009, 4:7-14.) Additionally, the inductive power apparatus includes power selector 60, which meets a voltage regulation circuit at least because it is used for "selecting a level of power emitted from the primary transformer winding," and utilizes control signals from controller

50 to output that controlled level of AC power. (EX1009, 1:64-2:13.) That is, the POSITA would understand the power selector 60 to include a circuit that regulates, *e.g.*, a root-mean-square (RMS) voltage level of the AC signal provided to the primary transformer winding 62, based on the selected level of power.

61. Additionally, Stephens discloses that AC/DC converter 70, of adapter 40, "produce[s] a regulated output consisting of a positive voltage and corresponding negative return voltage." (EX1009, 4:15-21.) The POSITA would thus understand the inductive power apparatus, via AC/DC converter 70, to include a voltage regulation circuit to produce that regulated output.

4. Claim 2

62. Stephens in view of Horowitz meets each limitation of claim 2, as described below.

a. [Preamble] ***The inductive battery charging system of claim 1,***

63. Stephens in view of Horowitz meets the preamble as described above for claim 1.

b. [A] ***wherein the relay switch of the separation module is deactivated when the target device and the inductive power apparatus are decoupled.***

64. Stephens in view of Horowitz meets this element. For example, Stephens discloses that the control signals are for "controlling the charging of a

battery pack in the proximity of the adapter," *i.e.*, by "control[ling] the level of an AC power signal output from the power selector". (EX1009, 2:5-10.) The control signals are based on proximity sensors that indicate when the battery pack is proximate to the adapter and "positioned for charging." (EX1009, 2:8-19, 3:50-58, 4:7-14, Fig. 1.) It would have been obvious that when the battery pack and the adapter are decoupled, and thus not positioned for charging, the control signals would deactivate the relay switch of the power selector 60, so as to not provide AC power to charge the battery.

65. To the extent that "wherein the relay switch … is deactivated" is understood to require disconnecting the relay switch itself from a power source, this is also met by Stephens in view of Horowitz: it would have been obvious to the POSITA to perform such disconnection when the target device and the inductive power apparatus are decoupled. This is to avoid unnecessary power consumption in the separation module, *e.g.*, power consumption by a light sensing component (*e.g.*, for a light source) in an opto-coupled relay, which does not need to detect light while the target device and inductive power apparatus are decoupled. (*See* EX1010, 595-99.) Avoiding such power consumption in a battery charging circuit would have been a goal of the POSITA.

5. Claim 3

66. Stephens in view of Horowitz meets each limitation of claim 3, as described below.

a. [Preamble] *The inductive battery charging system of claim 1, further comprising:*

67. Stephens in view of Horowitz meets the preamble as described above for claim 1.

b. [A] *a processor of the monitoring module coupled to the target device, wherein the processor is used to evaluate a target device battery power level with respect to the charging threshold.*

68. Stephens in view of Horowitz meets this element. For example, Stephens discloses that controller 50 includes "sensing, feedback and control logic" coupled to battery 12, such that "after a threshold voltage across battery 12 is sensed," controller 50 propagates control signals to discontinue charging. (EX1009, 3:8-26, 3:63-67.) Stephens further discloses that controller 50 "is preferably an Intel 8051 or like processor." (EX1009, 3:59-60.)

6. Claim 4

69. Stephens in view of Horowitz meets each limitation of claim 4, as described below.

a. [Preamble] ***The inductive battery charging system of claim 3, further comprising:***

70. Stephens in view of Horowitz meets the preamble as described above for claim 3.

b. [A] ***a battery monitor coupled to the target device to determine the target device battery power level;***

71. Stephens in view of Horowitz meets this element as described above for claim 3, element [A].

c. [B] ***wherein the target device is comprised of a mobile device.***

72. Stephens in view of Horowitz meets this element. For example, Stephens discloses that the battery pack 10 is suitable for use in a portable electronic device such as a cellular telephone. (EX1009, 2:49-52.) The POSITA would understand battery pack 10 to itself be a mobile device at least because of its inclusion in other mobile devices such as cellular telephones.

7. Claim 5

73. Stephens in view of Horowitz meets each limitation of claim 5, as described below.

a. [Preamble] ***The inductive battery charging system of claim 1, further comprising:***

74. Stephens in view of Horowitz meets the preamble as described above for claim 1.

b. [A] ***a sense feedback loop of the connection module to identify whether the target device is coupled with at least one of the inductive power apparatus and the alternating current power source;***

75. Stephens in view of Horowitz meets this element as described for claim 1, element [A].

c. [B] ***an input buffer of the connection module to receive a feedback signal; and***

76. Stephens in view of Horowitz meets this element. For example, Stephens discloses that controller 50 is configured to receive a "binary signal" propagated by proximity detector 68 to indicate that the battery pack is positioned for charging with respect to the adapter. (EX1009, 3:50-56.) Stephens additionally discloses that sensing logic receives signals from the sensors, and "provides feedback signals to the control logic" in controller 50. (EX1009, 3:14-26, 3:65-67.)

77. The feedback signal is received by an input buffer of the connection module at least because controller 50 is "preferably an Intel 8051 or like

processor." (EX1009, 3:59-4:6.) According to the '103 patent, an input buffer is met by General Purpose Input Output (GPIO) hardware, *e.g.*, a GPIO input port, such as the general purpose I/O ports used for input and output in the Intel 8051:

MCS®-51 ARCHITECTURAL OVERVIEW

INTRODUCTION

The 8051 is the original member of the MCS®-51 family, and is the core for all MCS-51 devices. The features of the 8051 core are:

- 8-bit CPU optimized for control applications
- Extensive Boolean processing (single-bit logic) capabilities
- 64K Program Memory address space
- 64K Data Memory address space
- 4K bytes of on-chip Program Memory
- 128 bytes of on-chip Data RAM
- 32 bidirectional and individually addressable I/O lines
- Two 16-bit timer/counters
- Full duplex UART
- 6-source/5-vector interrupt structure with two priority levels
- On-chip clock oscillator

The basic architectural structure of this 8051 core is shown in Figure 1.

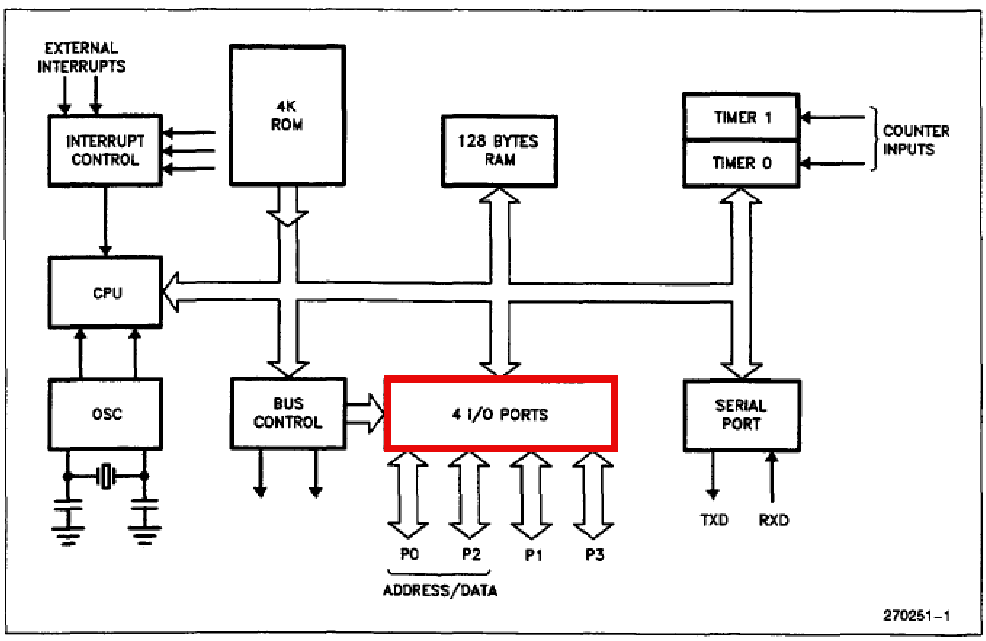


Figure 1. Block Diagram of the 8051 Core

(EX1001, 12:20-22, 14:60-64; EX1012, 1-3.)

d. [C] ***an interrupt controller module to generate an interrupt signal determined by the feedback signal received by the input buffer.***

78. Stephens in view of Horowitz meets this element. For example, Stephens discloses that controller 50 receives feedback signals provided by proximity detector 68, indicating whether the battery pack is ready for charging; and responds to the feedback signals "in turn" by "regulat[ing] AC/DC power converter 30 by setting known parameters therein." (EX1009, 3:16-23.) To the extent not expressly disclosed, it would have been obvious for controller 50 to include a interrupt controller module to generate the claimed interrupt signal—at least because the Intel 8051 provides five individually programmable interrupt sources, including external interrupt sources that can generate an interrupt signal and enter an interrupt service routine based on, *e.g.*, signals (such as from proximity detector 68) received at a GPIO input port, *e.g.*, an INTx pin. (EX1012, 1-20–1-22, 2-12–2-13, 3-23–3-25.) This is analogous to the '103 patent's description that "a logic state change on the input buffer 1138 will trigger an interrupt by the interrupt controller module 1042 to initiate an Interrupt Service Routine (ISR) by the processor 1044." (EX1001, 12:1-4.)

(i) Means-Plus-Function

79. If *interrupt controller module* is interpreted as a means-plus-function limitation, this element is still met by Stephens in view of Horowitz. (*See* ¶30.)

The recited function (*see* ¶30) is met as described above. With respect to structure, the ’103 patent discloses that the interrupt controller module responds to a logic state change on the input buffer, which is a GPIO input port, by causing a processor to initiate an ISR. (EX1001, 12:1-4, 14:60-64.) This is met at least equivalently by controller 50, which is preferably an Intel 8051 processor; as described above, the Intel 8051 includes interrupt sources that can generate an interrupt signal and enter an interrupt service routine based on, *e.g.*, changes in logic signals (e.g., from proximity detector 68) received at a GPIO input port, *e.g.*, an INTx pin. (EX1009, 3:59-60; EX1012, 1-20–1-22, 2-12–2-13, 3-23–3-25.)

8. Claim 6

80. Stephens in view of Horowitz meets each limitation of claim 6, as described below.

a. [Preamble] ***The inductive battery charging system of claim 4, further comprising:***

81. Stephens in view of Horowitz meets the preamble as described above for claim 4.

b. [A] ***an output buffer to generate an engage signal to control a coupling state of the inductive power apparatus and the alternating current power source.***

82. Stephens in view of Horowitz meets this element. As described above for claim 1, elements [C] and [D], controller 50 provides control signals to power selector 60 to couple and decouple the primary transformer winding 62 and the AC input.

83. The POSITA would understand the control signals to be generated by an output buffer at least because controller 50 is "preferably an Intel 8051 or like processor." (EX1009, 3:59-4:6.) According to the '103 patent, an output buffer is met by General Purpose Input Output (GPIO) hardware, *e.g.*, a GPIO output port, such as the general purpose I/O ports used for input and output in the Intel 8051:

intel. MCS®-51 ARCHITECTURAL OVERVIEW

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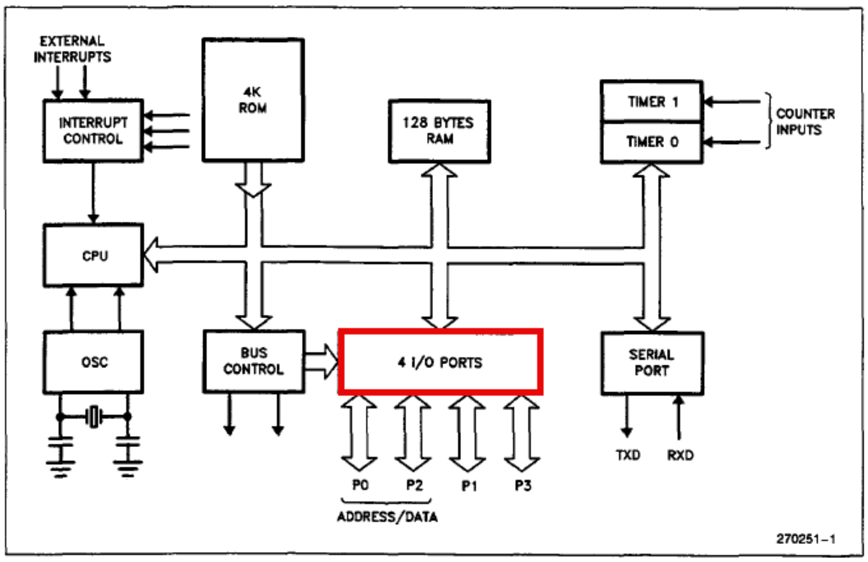


Figure 1. Block Diagram of the 8051 Core

(EX1001, 12:20-22, 15:23-26; EX1012, 1-3.)

84. Additionally, a coupling state of the inductive power apparatus and the alternating current power source is met by power selector 60's selection of an AC voltage for provision to the primary winding 62; as the POSITA would understand, a higher output voltage would result in a greater coupling between the inductive power apparatus (*e.g.*, the primary winding 62) and the AC power source, and vice versa.

9. Claim 8

85. Stephens in view of Horowitz meets each limitation of claim 8, as described below.

a. [Preamble] *The inductive battery charging system of claim 1,*

86. Stephens in view of Horowitz meets the preamble as described above for claim 1.

b. [A] *wherein the connection module determines whether the target device and the inductive power apparatus are coupled together by determining whether power is being provided to the target device by the inductive power apparatus.*

87. Stephens in view of Horowitz meets this element. As described for claim 1, element [A], the connection module includes controller 50 in communication with proximity indicating device 38 and proximity detector 68. As described for claim 1, element [B], controller 50 receives various "sensed battery conditions" from the battery 12. (EX1009, 3:63-4:6.) These battery conditions include, *e.g.*, an "instantaneous current," which the POSITA would understand to indicate whether power is being provided to the battery by the adapter 40. (EX1009, 2:52-57.)

88. To the extent not expressly disclosed, it would have been obvious to the POSITA to use the instantaneous current data to determine whether the target

device and inductive power apparatus are coupled together. While Stephens' proximity indicating device 38 and proximity detector 68 indicate whether the target device and inductive power apparatus are in close proximity, that proximity information alone may not reliably indicate whether the target device and inductive power apparatus are coupled. For example, as the POSITA would understand, the proximity detector 68 might be subject to false positives, *e.g.*, because debris or other obstacles may cause the proximity detector 68 to register the presence of an object that is not the target device. It would have been obvious for the POSITA to use the instantaneous current data to confirm that the proximate object is in fact the target device, and that the target device and the inductive power apparatus are coupled, *e.g.*, by confirming that current is actively being applied to the target device 10 to charge the battery 12.

10. Claim 9

89. Stephens in view of Horowitz meets each limitation of claim 9, as described below.

a. [Preamble] *The inductive battery charging system of claim 1,*

90. Stephens in view of Horowitz meets the preamble as described above for claim 1.

b. [A] ***wherein the supplemental power source is comprised of at least one of a target device battery, a charger system battery and an alternate inductive power apparatus.***

91. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [B].

11. Claim 11

92. Stephens in view of Horowitz meets each limitation of claim 11, as described below.

a. [Preamble] ***An inductive battery charging method, comprising:***

93. Stephens in view of Horowitz meets the preamble at least as described above for claim 1, [Preamble].

b. [A] ***identifying whether a target device is coupled to an inductive power apparatus;***

94. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [A].

c. [B] ***determining whether a power level of a target device battery is below a lower charging threshold while using power from a supplemental power source;***

95. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [B]. For example, Stephens discloses that charging is

discontinued below a threshold voltage. (EX1009, 2:52-57, 2:64-67, 3:1-7, 3:14-33, 3:63-4:6.)

d. [C] ***automatically engaging the inductive power apparatus and an alternating current power source when a lower available power threshold of a battery is reached;***

96. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [C]. To the extent not expressly disclosed, it would have been obvious to automatically reconnect Stephens' inductive power apparatus to the AC power source upon reaching a lower available power threshold, such that the battery does not deplete after being decoupled.

e. [D] ***automatically decoupling the inductive power apparatus and the alternating current power source when a desired threshold power level of the target device battery is reached,***

97. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [D].

f. [E] ***wherein the inductive power apparatus includes at least one of a transformer to inductively generate an electric current, a rectification circuit, and a voltage regulation circuit; and***

98. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [F].

g. [F] *deactivating an opto-coupled relay of the inductive power apparatus when the target device and the inductive power apparatus are decoupled.*

99. Stephens in view of Horowitz meets this element at least as described above for claim 1, elements [D] and [E], and claim 2, element [A]. For example, as described above, Stephens teaches deactivating a relay of the inductive power apparatus (*e.g.*, power selector 60) when the target device (*e.g.*, battery pack 10) and the inductive power apparatus are decoupled. In addition, Horowitz teaches that the relay switch of power selector 60 can comprise an opto-coupled relay. For example, in a passage titled "Opto-couplers and relays," Horowitz describes opto-couplers (which the POSITA would understand to meet opto-coupled relays) as "very useful," and identifies numerous technical advantages, including galvanic isolation and isolation of digital noise. (EX1010, 595.) Horowitz goes so far as to characterize opto-couplers as "*essential* in circuits that interact with the ac power mains"—such as power selector 60 in Stephens, which interacts with both the primary transformer winding 62 and the AC power mains. (EX1010, 595 (emphasis added).) In addition to the reasons described above for claim 1, elements [C] and [D], the POSITA would be motivated to combine power selector 60 with the opto-coupled relays described in Horowitz in order to realize the advantages described by Horowitz, and because the POSITA would understand the combination to be "essential."

100. Additionally, Horowitz provides specific instructions for integrating opto-coupled relays into electronic circuits, including circuit schematics for "nearly every kind of opto-coupler you are likely to encounter." (EX1010, 595-98, Fig. 9.26.) Thus, the POSITA would have had a reasonable expectation of success in making the combination.

101. Further, as described above for claim 2, to the extent that the claimed "deactivating" the opto-coupled relay is understood to require disconnecting the relay itself from a power source, this is also met by Stephens in view of Horowitz: it would have been obvious to the POSITA to perform such disconnection when the target device and the inductive power apparatus are decoupled. This is to avoid unnecessary power consumption in the separation module, *e.g.*, power consumption by a light sensing component (*e.g.*, for a light source) in the opto-coupled relay, which does not need to detect light while the target device and inductive power apparatus are decoupled. (*See* EX1010, 595-99.) Avoiding such power consumption in a battery charging circuit would have been a goal of the POSITA.

12. Claim 12

102. Stephens in view of Horowitz meets each limitation of claim 12, as described below.

a. **[Preamble]** ***The inductive battery charging method of claim 11,***

103. Stephens in view of Horowitz meets the preamble as described above for claim 11.

b. **[A]** ***wherein the power level of the target device battery is determined using a processor and a battery monitor, and***

104. Stephens in view of Horowitz meets this element at least as described above for claim 4, element [A]. The power level is determined using a processor at least because Stephens discloses that controller 50 is preferably an Intel 8051 processor. (EX1009, 3:59-60.)

c. **[B]** ***wherein the target device is comprised of a mobile device coupled to the processor and the battery monitor.***

105. Stephens in view of Horowitz meets this element at least as described above for claim 4, element [B].

13. Claim 13

106. Stephens in view of Horowitz meets each limitation of claim 13, as described below.

a. **[Preamble]** ***The inductive battery charging method of claim 12, further comprising:***

107. Stephens in view of Horowitz meets the preamble as described above for claim 12.

b. [A] ***identifying a coupling of the inductive power apparatus and the target device using a sense feedback loop;***

108. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [A].

c. [B] ***receiving a feedback signal using an input buffer;***

109. Stephens in view of Horowitz meets this element at least as described above for claim 5, element [B].

d. [C] ***transmitting an interrupt signal determined in accordance with the feedback signal received by the input buffer; and***

110. Stephens in view of Horowitz meets this element at least as described above for claim 5, element [C].

e. [D] ***adapting a coupling state of the inductive power apparatus and the alternating current power source based on the interrupt signal.***

111. Stephens in view of Horowitz meets this element at least as described above for claim 5, element [C]. To the extent not expressly disclosed in Stephens, it would have been obvious for controller 50 to respond to the feedback signals by controlling power selector 60—*e.g.*, to couple/decouple the inductive power apparatus and the AC power source as described above for claim 1, elements [C] and [D]—at least because Stephens discloses that power converter 30 and power

selector 60 can perform analogous functions, and that either or both can "control the level of an AC power signal output." (EX1009, 2:8-13.)

112. Additionally, as described above for claim 6, element [A], adapting a coupling state of the inductive power apparatus and the alternating current power source is met by controller 50 controlling power selector 60's selection of an AC voltage for provision to the primary winding 62; as the POSITA would understand, a higher output voltage would result in a greater coupling between the inductive power apparatus (*e.g.*, the primary winding 62) and the AC power source, and vice versa.

14. Claim 14

113. Stephens in view of Horowitz meets each limitation of claim 14, as described below.

a. [Preamble] *An inductive battery charging system, comprising:*

114. Stephens in view of Horowitz meets the preamble at least as described above for claim 1, [Preamble].

b. [A] ***a connection module to confirm whether a target device is coupled to an inductive power apparatus, wherein the inductive power apparatus is comprised of a transformer and the target device is comprised of a mobile device;***

115. Stephens in view of Horowitz meets this element at least as described above for claim 1, elements [A] and [F], and claim 4, element [B].

(i) Means-Plus-Function

116. If *connection module* is interpreted as a means-plus-function limitation, this element is met as described above for claim 1, element [A]. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. And the corresponding structure is met as described for claim 1, element [A].

c. [B] ***a sense feedback loop of the connection module to identify whether the target device is coupled to an alternating current power source using at least one of a sense feedback signal and a power transmitted from the alternating current power source to the target device;***

117. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [A]. The sense feedback signal is met at least by an output of the proximity detector 68.

d. [C] ***a monitoring module to detect whether a target device battery is below a charging threshold while using power from a supplemental power source;***

118. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [B].

(i) Means-Plus-Function

119. If *monitoring module* is interpreted as a means-plus-function limitation, this element is met as described above for claim 1, element [B]. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. And the corresponding structure is met as described for claim 1, element [B].

e. [D] ***a battery monitor coupled to the target device to determine a target device battery power level;***

120. Stephens in view of Horowitz meets this element at least as described above for claim 3, element [A].

f. [E] ***a processor of the monitoring module coupled to the target device, wherein the processor is used to evaluate the target device battery power level with respect to the charging threshold;***

121. Stephens in view of Horowitz meets this element at least as described above for claim 3, element [A].

g. [F] ***an activation module to automatically couple the target device and the alternating current power source using the inductive power apparatus when the target device battery is below the charging threshold; and***

122. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [C].

(i) Means-Plus-Function

123. If *activation module* is interpreted as a means-plus-function limitation, this element is met as described above for claim 1, element [C]. (*See* ¶30.) The

recited function (*see* ¶30) is met as described above. And the corresponding structure is met as described for claim 1, element [C].

h. [G] ***a separation module to automatically decouple the target device and the alternating current power source when a desired charging state of the target device battery is detected by the monitoring module,***

124. Stephens in view of Horowitz meets this element at least as described above for claim 1, element [D].

(i) Means-Plus-Function

125. If *separation module* is interpreted as a means-plus-function limitation, this element is met as described above for claim 1, element [D]. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. And the corresponding structure is met as described for claim 1, element [D].

i. [H] ***wherein the separation module is comprised of an opto-coupled relay.***

126. Stephens in view of Horowitz meets this element at least as described above for claim 11, element [F].

B. Ground 2: Claims 1, 2, and 9-11 are Rendered Obvious by Toya in View of Horowitz

127. It is my view that Toya in view of Horowitz teaches each and every limitation of claims 1, 2, and 9- 11 of the ’103 patent, for the reasons set forth below.

1. Summary of Toya

128. Toya is the publication of a U.S. patent application (Appl. No. 11/889,297, "Battery Charger") by inventor Shoichi Toya. The application was filed on August 10, 2007 (claiming priority to a Japanese patent application filed August 11, 2006); published on March 13, 2008; and ultimately issued as U.S. Patent No. 7,633,293 on December 15, 2009. Toya is thus prior art to the '103 patent under at least 35 U.S.C. §§102(a), (b), and (e). Even if the '103 patent were afforded its earliest possible priority date of July 4, 2008—the filing date of the earliest application to which it claims priority—Toya would still be prior art under at least §§102(a) and (e).

129. Toya discloses an inductive battery charger without electrical contacts. (EX1011, [0008].) A high frequency power supply provides power to a primary coil, which magnetically couples with a secondary coil housed in portable electronic equipment (*e.g.*, a mobile phone) and conveys power to the secondary coil via magnetic induction. (EX1011, [0008].) The induced AC power is then rectified to charge a battery pack in the portable electronic equipment. (*Id.*) The battery charger also includes an internal battery; when power is not input to the battery charger, power is supplied to the high frequency power supply from the internal battery, which is used to charge the battery pack as described above. (*Id.*)

130. Toya further discloses that the battery pack can include a "full charge detection circuit" to detect a full battery charge; and a "charge termination circuit" to suspend charging when the full battery charge is detected. (EX1011, [0022]-[0023].) Toya's battery charger can thus "switch the power supply off after the battery pack has been fully charged to prevent wasted power consumption." (EX1011, [0022]-[0023], [0045].)

131. Toya is analogous art to the claimed invention because it is directed to the same field of endeavor—electronic circuits, including for battery charging. For example, Toya's disclosure of battery packs, AC adapters, and battery charging systems is analogous to disclosures in the '103 patent of device batteries, AC current power sources, and battery charging systems. (*See, e.g.*, EX1011, Abstract; EX1001, Abstract, Fig. 9.) Further, Toya discloses that its systems are for portable electronic equipment including cell phones—analogous to those of the '103 patent. (EX1011, [0004], Fig. 5; EX1001, 5:27-29.) Further, Toya is reasonably pertinent to the problem faced by the '103 patent inventor; for example, Toya discloses circuitry for suspending charging when a full battery charge is detected, thus "prevent[ing] wasted battery power consumption." (EX1011, [0023].) This is pertinent to the '103 patent's problem of "prevent[ing] a vampiric power loss" that can occur in a battery charging system. (EX1001, 1:26-62.)

2. Claim 1

132. Toya in view of Horowitz meets each limitation of claim 1, as described below.

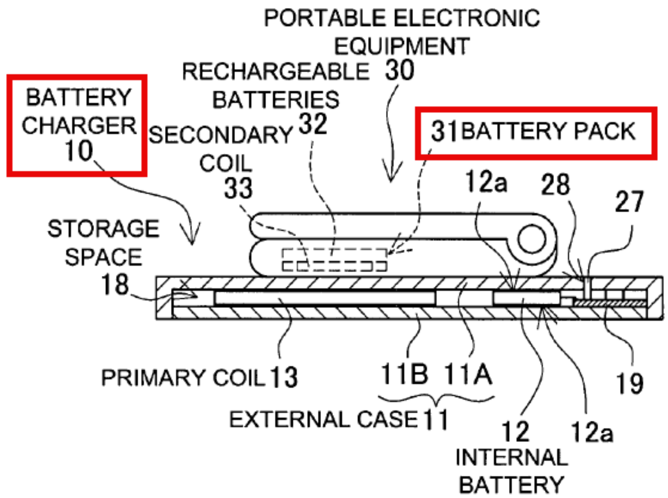
a. [Preamble] *An inductive battery charging system, comprising:*

133. Toya in view of Horowitz meets the preamble. For example, Toya discloses a "battery charger without electrical contacts," with which a battery can be "charged by electrical power induced in the secondary coil." (EX1011, [0002], [0021].)

b. [A] *a connection module to determine when a target device is coupled to an inductive power apparatus;*

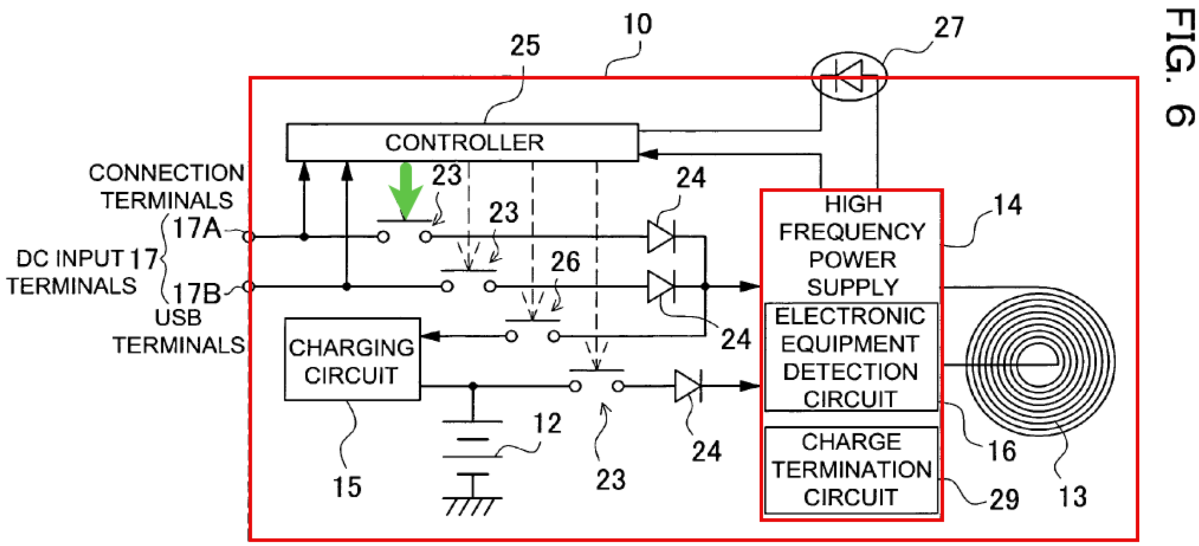
134. Toya in view of Horowitz meets this element. For example, Toya discloses at least an inductive power apparatus that includes battery charger 10 and battery pack 31 (or 51). (EX1011, [0056]-[0059], Figs. 5-8.) The battery pack may be housed in a target device (*e.g.*, portable electronic equipment 30) that is set in charging position and charged by the battery charger:

FIG. 5



(EX1011, [0056], Fig. 5 (annotated).)

135. The battery charger 10 includes a high frequency power supply 14 and a primary coil 13. (EX1011, [0008], Fig. 6.) The high frequency power supply 14 includes an electronic equipment detection circuit 16 to determine if the portable electronic equipment 30 is set in position for charging. (EX1011, [0045].) When portable electronic equipment 30 is set in position and DC power is supplied, the high frequency power supply 14 supplies high frequency power to the primary coil 13. (EX1011, [0008], [0045].)



(EX1011, [0056], Fig. 6 (annotated).)

136. The battery pack 31 (or 51) includes rechargeable battery 32 and secondary coil 33. (EX1011, [0008].) The primary coil 13 of the battery charger 10 magnetically couples with the secondary coil 33. (EX1011, [0008].) High frequency power in the primary coil 13 is conveyed to the secondary coil 33 by magnetic induction, and current in the secondary coil 33 is rectified to charge the rechargeable battery 32. (EX1011, [0008].)

FIG. 7

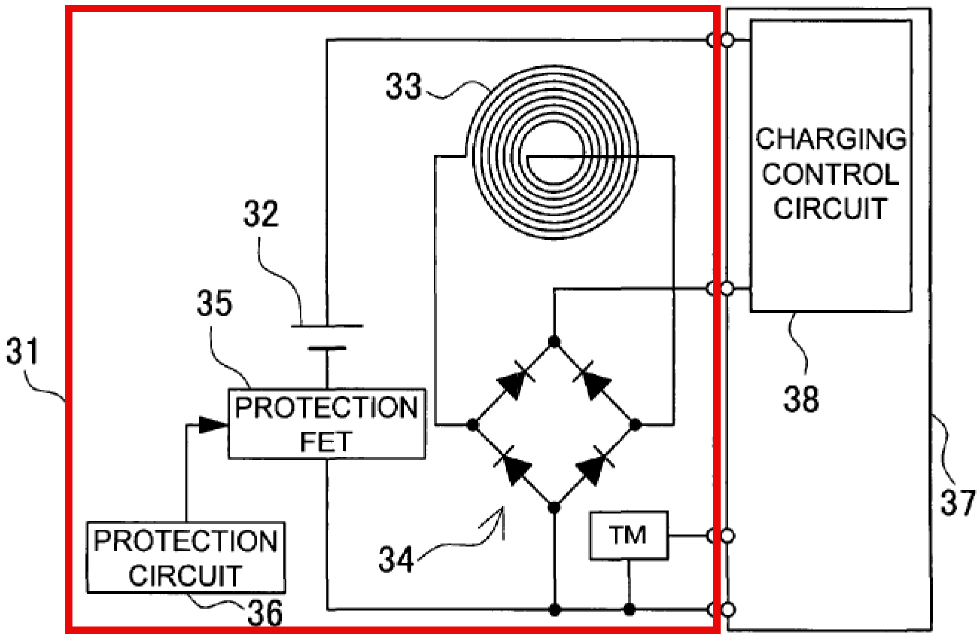
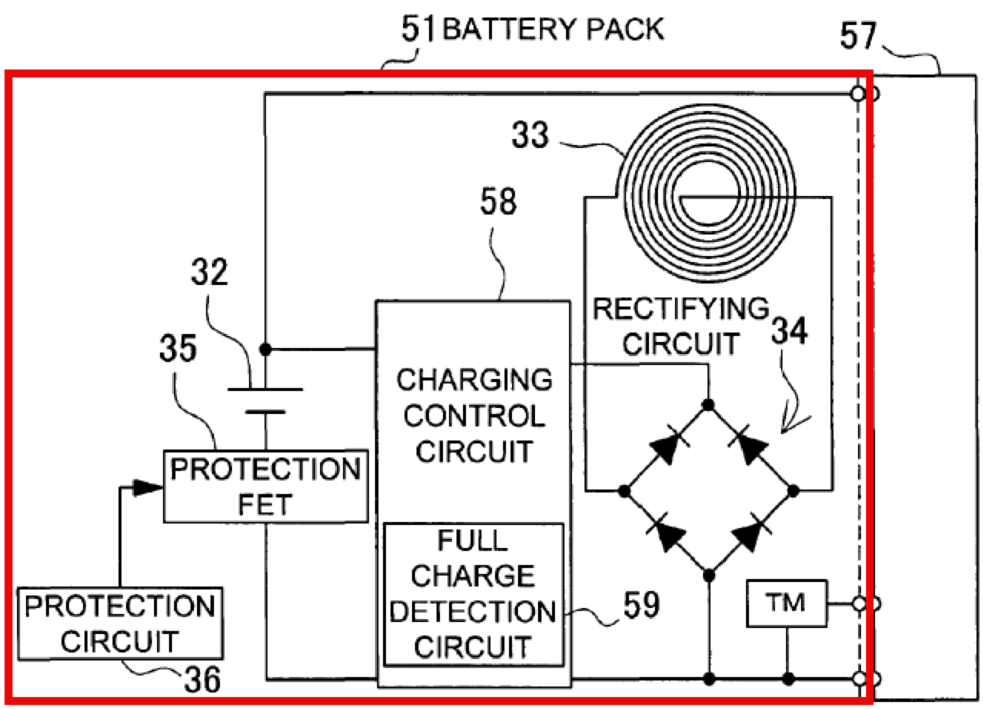


FIG. 8



(EX1011, [0056], Figs. 7, 8 (annotated).)

137. The claimed connection module is met at least by controller 25 and the high frequency power supply 14, which determine if the target device (portable electronic equipment 30) is set in position for charging. (EX1011, [0045], [0051]-[0054], Fig. 6.) Controller 25 makes this determination based on an electronic equipment data signal transmitted from the portable electronic equipment 30 to the electronic equipment detection circuit 16 of the power supply 14. (EX1011, [0045], Fig. 6.) Toya explains that when the portable electronic equipment 30 is set for charging, it is positioned such that the secondary coil 33 is adjacent to the top plate 11A of the battery charger 10 and opposite the primary coil 13, such that the battery charger 10 may charge the battery pack 31 via the magnetic coupling of primary coil 13 and secondary coil 33. (EX1011, [0048], [0059], Figs. 2-3, 5-6.) The POSITA would thus understand determining if the target device is set in position for charging to meet determining whether the target device is coupled to the inductive power apparatus (*e.g.*, whether portable electronic equipment 30 is magnetically coupled to primary coil 13 of the inductive power apparatus via secondary coil 33).

(i) Means-Plus-Function

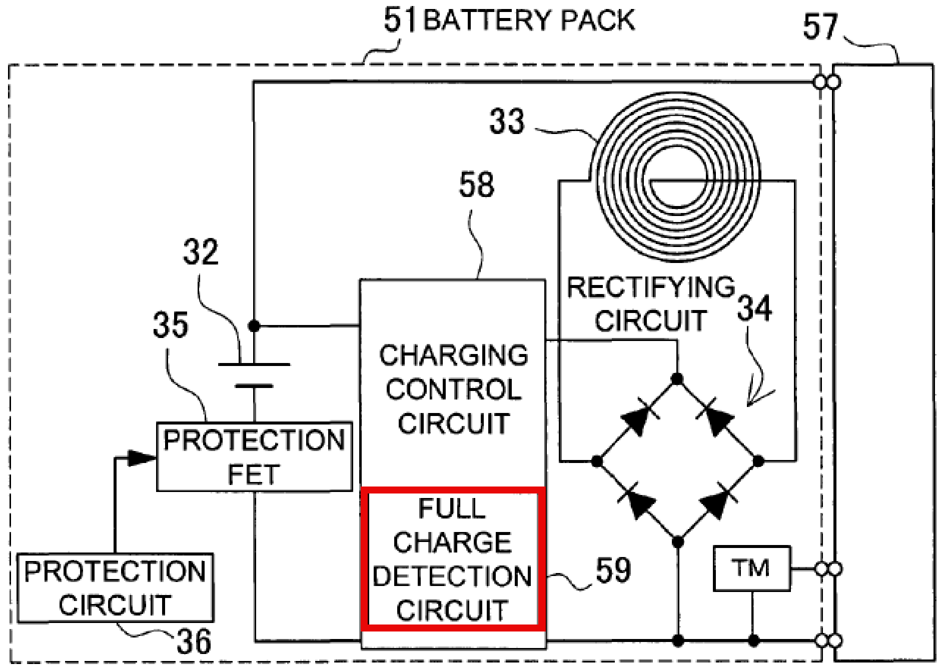
138. If *connection module* is interpreted as a means-plus-function limitation, this element is still met by Toya in view of Horowitz. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. Further, it would have been

obvious for controller 25 to include a processor with an input buffer, at least via general purpose I/O ports used for input and output (*e.g.*, to receive an electronic equipment data signal from primary coil 13), such as discussed for Ground 1, claim 5, element [B]. (EX1001, 12:20-22, 14:60-64; EX1011, [0051]-[0052]; EX1012, 1-3.) For the purposes of this proceeding, this is equivalent to the '103 patent's disclosure of connection module 918 comprising input buffer 1038 that receives input indicative of a coupling state. (EX1001, 11:55-57, 12:9-19, Fig. 10.)

c. [B] ***a monitoring module to determine when a target device battery is below a charging threshold while using power from a supplemental power source; and***

139. Toya in view of Horowitz meets this element. For example, Toya discloses that the battery pack 51 includes a full charge detection circuit 59 to detect whether the target device's rechargeable battery 32 is fully charged:

FIG. 8



(EX1011, [0022], [0057], Fig. 8 (annotated).)

140. When the rechargeable battery 32 reaches full charge, the full charge detection circuit 59 issues a full charge signal. (EX1011, [0057].) The POSITA would understand detecting whether the battery 32 reaches full charge to meet determining whether the battery is below a charging threshold (*i.e.*, a threshold representing a full charge).

141. The supplemental power source is met at least by the internal battery 12 of the battery charger 10. (EX1011, [0022], Fig. 6.) As Toya explains, when there is no input power applied to the battery charger 10, the internal battery 12 acts as a supplemental power source by charging the battery pack via the high frequency power supply 14 and primary coil 13. (EX1011, [0008], [0044].)

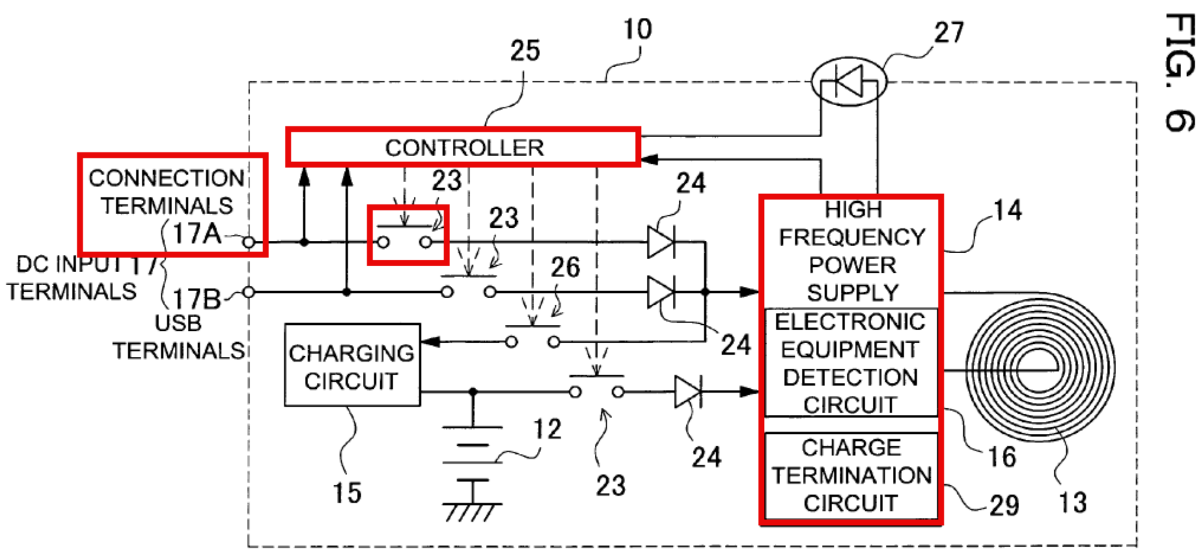
142. Additionally, the supplemental power source is met by battery 32 itself, consistent with dependent claim 9's recitation that the supplemental power source is comprised of "*at least one of a target device battery*, a charger system battery and an alternate inductive power apparatus." (EX1001, 19:27-30 (emphasis added), 2:51-53.) Claim 9's limitation of the supplemental power source indicates that a supplemental power source comprising a target device battery, such as battery 32, is within the scope of the parent claim 1.

(i) Means-Plus-Function

143. If *monitoring module* is interpreted as a means-plus-function limitation, this element is still met by Toya in view of Horowitz. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. As described above, detection circuit 59 is configured to detect whether the target device's rechargeable battery 32 is fully charged. (EX1011, [0022], [0057], Fig. 8.) For the purposes of this proceeding, this is equivalent to the '103 patent's disclosure that a processor and a battery monitor of the monitoring module are coupled to the target device 916 to evaluate the target device's battery level. (EX1001, 11:1-5.)

d. [C] ***an activation module to automatically couple the inductive power apparatus and an alternating current power source when a power level of the target device battery is below the charging threshold;***

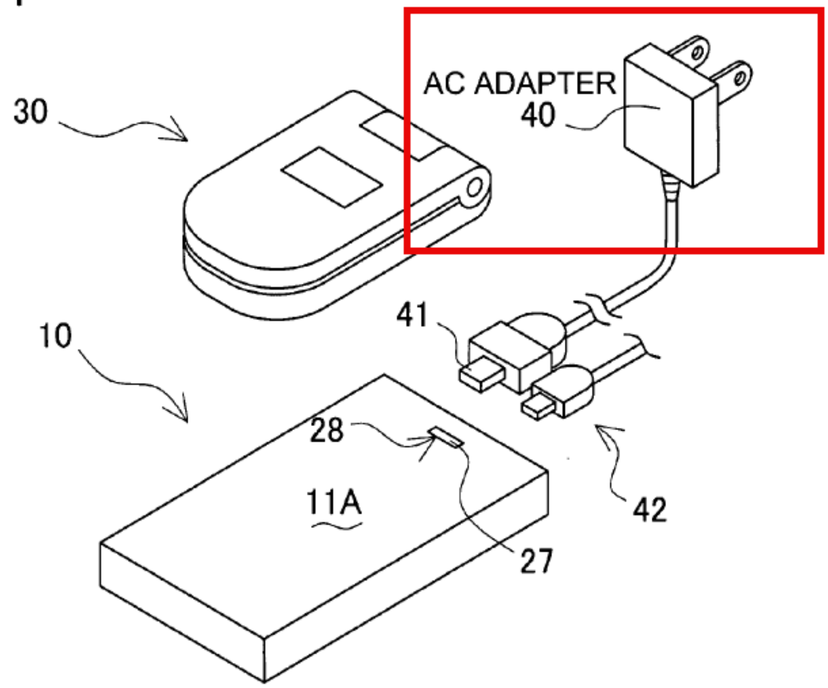
144. Toya in view of Horowitz meets this element. For example, Toya discloses that in battery charger 10, controller 25 can independently turn switches 23 on or off to couple or decouple AC adapter connection terminals 17A from the power supply circuit of the high frequency power supply 14 of the inductive power apparatus:



(EX1011, [0051]-[0052], Fig. 6 (annotated).)

145. The AC adapter connection terminals 17A receive DC power via an AC adapter 40, as shown in Figure 1:

FIG. 1



(EX1011, [0014]-[-0015], [0046], Fig. 1 (annotated).)

146. The POSITA would understand an AC adapter, such as AC adapter 40, to couple to an alternating current (AC) power source. This is evident to the POSITA at least by the prongs of AC adapter 40 shown in Figure 1, which are configured for insertion into a standard wall outlet providing AC power, such as a North American NEMA 5-15 outlet. (*See* EX1013, 92-94.)

147. The claimed activation module is met at least by controller 25. (EX1011, [0051]-[0052].) When controller 25 detects that the portable electronic equipment 30 is set for charging and power is input via the AC adapter connection terminals 17A, controller 25 automatically switches on the switch 23 that is connected to terminals 17A, thus coupling the inductive power apparatus to an AC

power source via the AC adapter 40 and initiating charging of the portable equipment 30's battery 32. (EX1011, [0051]-[0052], Fig. 6.) In the annotated Figure 6 below, the blue path indicates the coupling between the inductive power apparatus (*e.g.*, high frequency power supply 14) and connection terminals 17A, which are coupled to an AC power source via AC adapter 40 as described above, when the switch 23 associated with terminals 17A is closed (turned on):

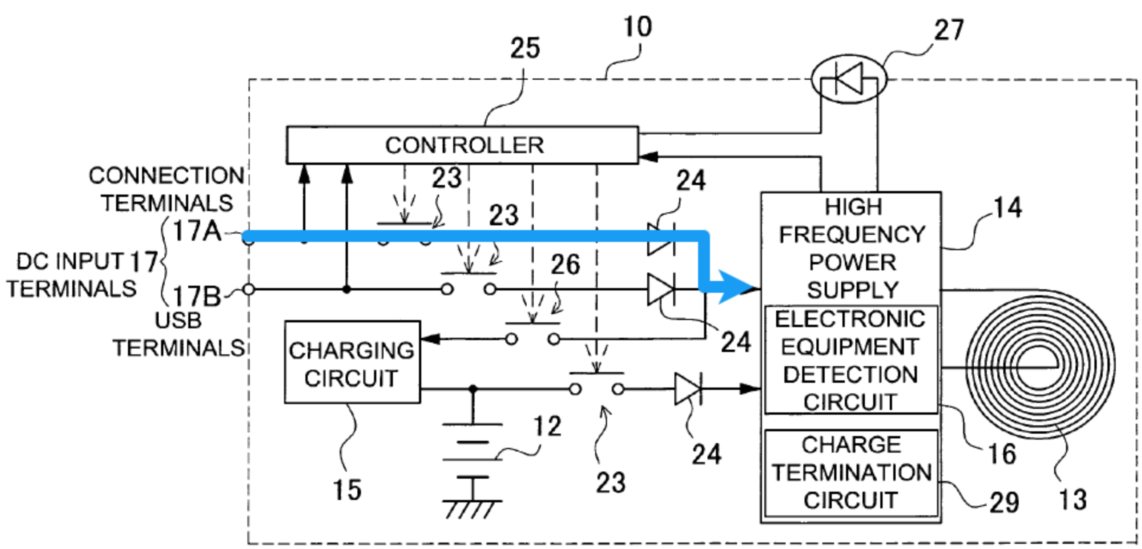


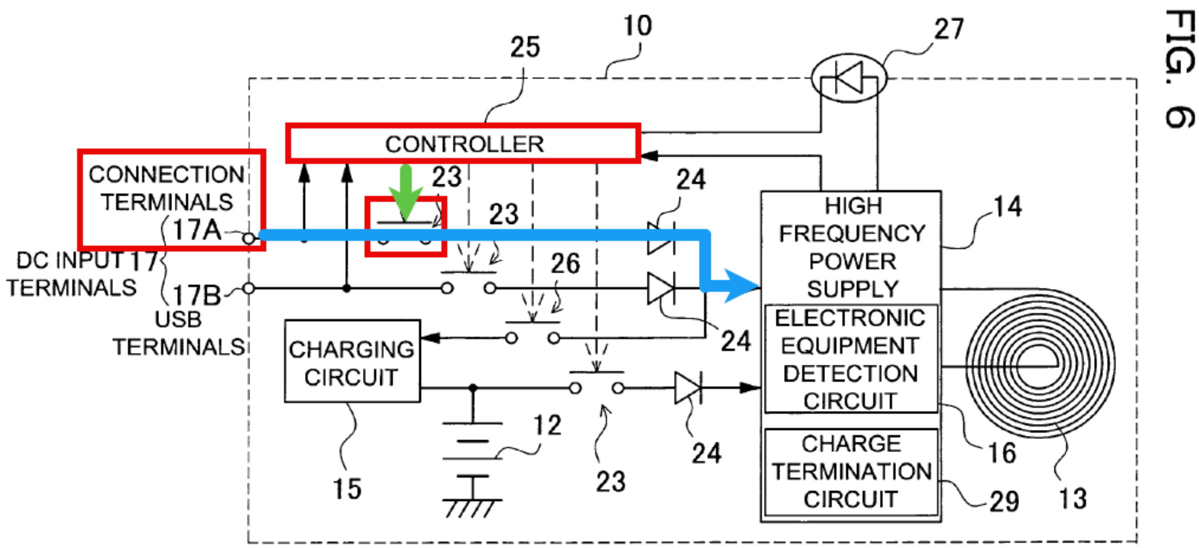
FIG. 6

(EX1011, [0051]-[0052], Fig. 6 (annotated).)

148. Controller 25 uses data signals from the battery pack to detect when the portable electronic equipment 30 is set for charging. (EX1011, [0051], [0052], [0057].) When battery 32 reaches a charging threshold (*i.e.*, a full charge), a full charge signal is generated by full charge detection circuit 59; and detected by the charge termination circuit 29, which then cuts off the supply of power to the

inductive power apparatus (*i.e.*, via controller 25 turning off switch 23). (EX1011, [0051], [0052], [0057], Figs. 6, 8.)

149. The POSITA would understand that, conversely, when the battery 32 is below the charging threshold, the full charge signal is not detected, and coupling is permitted (*i.e.*, via controller 25 turning on switch 23) between the inductive power apparatus the AC power source (via connection terminals 17A) as described above:



(EX1011, [0022]-[0023], [0051]-[0052], [0057], Figs. 6, 8.)

150. This is at least because POSITA would understand that once the power supply is cut off to the battery, the battery's power level will dissipate (particularly if the battery pack is installed in a device such as a notebook computer or cellular telephone, *see* EX1011, Fig. 5), such that it would eventually deplete without being reconnected to the power source for recharging. The

POSITA would understand this to defeat the purpose of Toya's battery charging system, which is to provide a battery charger to "sufficiently" charge rechargeable batteries such as lithium-ion batteries. (EX1011, [0011]-[0012].) The POSITA would understand that the regulation of such batteries is known in the art. (*See* EX1009, 3:31-33.) The POSITA thus would understand Toya's charger to apply known techniques to couple the inductive apparatus to the rechargeable battery 32 and maintain its charge.

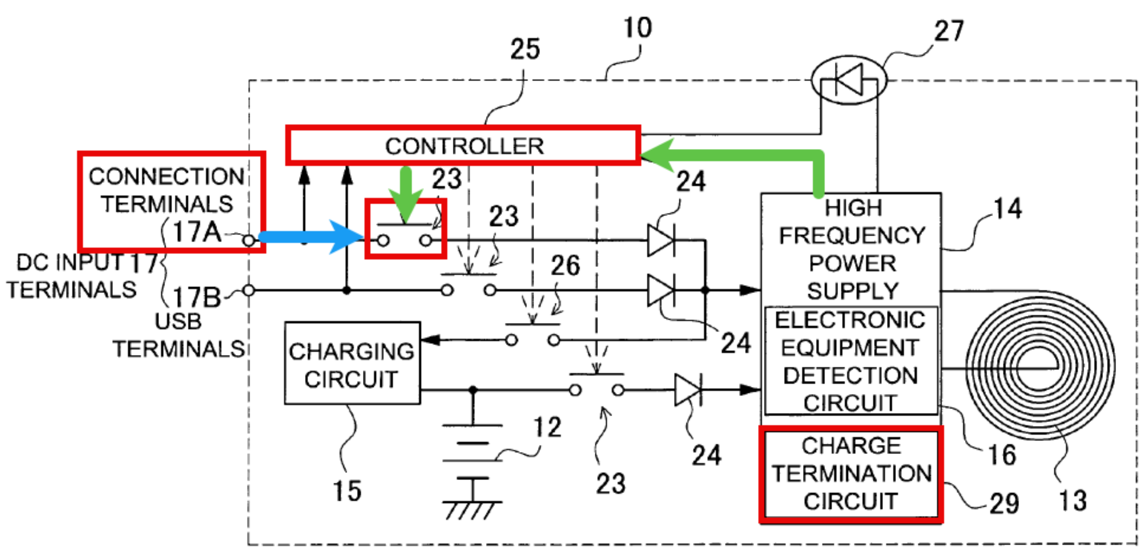
(i) Means-Plus-Function

151. If *activation module* is interpreted as a means-plus-function limitation, this element is met because Toya in view of Horowitz teaches the recited function and its corresponding structure. (*See* ¶30.) The recited functions (*see* ¶30) are met as described above.

152. With respect to structure, the '103 patent discloses that the activation module uses a processor to permit current to the separation module, *i.e.*, to couple or decouple the transformer 104 from the AC power source 102, as described above. (EX1001, 17:5-9.) This is met at least equivalently by controller 25, which, as described above, is a processor that provides signals to switches 23, connected to terminals 17A, thus coupling/decoupling the inductive power apparatus to an AC power source via the AC adapter 40 (EX1011, [0051]-[0054], Fig. 6.)

e. **[D]** ***a separation module to automatically decouple the inductive power apparatus and the alternating current power source when a desired charging state of the target device battery is observed,***

153. Toya in view of Horowitz meets this element. The separation module is met at least by controller 25 and switches 23. Switches 23 can be independently turned on and off by controller 25. (EX1011, [0051].) For example, as described above for elements [C] and [D], Toya discloses that when battery 32 reaches a desired charging state (*i.e.*, a fully charged state), the full charge signal is generated and is detected by the charge termination circuit 29, which then cuts off the supply of power to the inductive power apparatus (*e.g.*, via controller 25 turning off the switch 23 associated with terminals 17A):



(EX1011, [0022]-[0023], [0051]-[0052], [0057], Figs. 6 (annotated), 8.)

(i) Means-Plus-Function

154. If *separation module* is interpreted as a means-plus-function limitation, this element is met because Toya in view of Horowitz teaches the recited function and its corresponding structure. (*See* ¶30.) The recited functions (*see* ¶30) are met as described above.

155. With respect to structure, as described above, Toya in view of Horowitz teaches that the separation module comprises relay switches 23. Further, as described in the ’103 patent, the switches 23 may include opto-coupled relays (as shown below for claim 11, element [F]) or electromechanical relays (such as described in Horowitz). (EX1001, 3:50-51; EX1010, 55, 595-98.) Further, as described above for Toya, when battery 32 reaches a fully charged state, a full charge signal is generated and used to cut off the supply of power to the inductive power apparatus. (EX1011, [0022]-[0023], [0051]-[0052], [0057], Figs. 6, 8.) For the purposes of this proceeding, this is equivalent to the ’103 patent’s disclosure that the separation module receives an output voltage of a comparator, which controls whether a relay couples or decouples the transformer 104 from the AC power source 102. (EX1001, 7:55-8:5, 8:22-29, Fig. 9.)

f. [E] *wherein the separation module is comprised of a relay switch,*

156. Toya in view of Horowitz meets this element. For example, as described above for element [D], Toya discloses a separation module comprising

controller 25 and switches 23. However, Toya does not expressly provide what type of switch for switches 23. Accordingly, the POSITA seeking to use the inductive charging system of Toya would have looked to other references, such as Horowitz, for details of how to implement switches 23.

157. The POSITA would have consulted Horowitz's disclosure of relay switches for combination with Toya's switches 23. The POSITA would have been motivated to do so: for example, Horowitz explains that a "primary use[]" of relays is for high-voltage or high-current switching, including potentially the switching in Toya. (EX1010, 55.) The POSITA would understand relays to be particularly useful in circuits such as in Toya, where low-voltage microprocessor signals (*i.e.*, of controller 25) are used to switch higher-voltage DC signals (*i.e.,* provided via terminals 17A/17B). Horowitz also describes advantages of relays, including providing electrical isolation of control signals (*e.g.*, signals provided by controller 25). The POSITA would have been motivated to make the combination to realize these advantages. Further, Horowitz provides implementation details, including circuit schematics, that the POSITA would have utilized in combining Horowitz's relay switches with Toya. (*See*, *e.g.*, EX1010, 595-98.) Accordingly, the POSITA would have had a reasonable expectation of success in making the combination.

g. [F] *wherein the inductive power apparatus includes at least one of a transformer to inductively generate an electric current, a rectification circuit, and a voltage regulation circuit.*

158. Toya in view of Horowitz meets this element. For example, the battery charger 10 in Toya includes primary coil 13 of a transformer, which inductively couples to secondary coil 33 to generate an electric current. (EX1011, [0008].) Further, the POSITA would understand the battery charger's AC adapter 40 to belong to the inductive power apparatus, because the AC adapter provides a power source for the battery charger 10; and would further understand the AC adapter to include both a rectifier circuit and a voltage regulation circuit, for converting AC input to voltage-regulated DC output. (*See* EX1013, 92-94; EX1011, [0046]-[0047], Fig. 6.)

3. Claim 2

159. Toya in view of Horowitz meets each limitation of claim 2, as described below.

a. [Preamble] *The inductive battery charging system of claim 1,*

160. Toya in view of Horowitz meets the preamble as described above for claim 1.

b. [A] *wherein the relay switch of the separation module is deactivated when the target device and the inductive power apparatus are decoupled.*

161. Toya in view of Horowitz meets this element as described for claim 1, element [D]. For example, controller 25 detects an electronic equipment data signal induced in the primary coil 13 to determine that portable electronic equipment is "set for charging." (EX1011, [0051].) Toya discloses that when this data signal indicates that the portable electronic equipment is set for charging, controller 25 accordingly "turns ON any switch 23," and supplies power to the primary coil 13 (and thus the battery 32). (EX1011, [0051]-[0054].) To the extent not expressly disclosed, it would have been obvious that when the portable electronic equipment and the battery charger are decoupled, and thus not set for charging, the controller would conversely deactivate the relay switch 23 coupling the primary coil 13 (and thus battery 32) to AC power, so as to not provide AC power to charge the decoupled battery.

162. To the extent that the claimed "wherein the relay switch … is deactivated" is understood to require disconnecting the relay switch itself from a power source, this is also met by Toya in view of Horowitz: it would have been obvious to the POSITA to perform such disconnection when the target device and the inductive power apparatus are decoupled. This is to avoid unnecessary power consumption in the separation module, *e.g.*, power consumption by a light sensing

component (*e.g.*, for a light source) in an opto-coupled relay, which does not need to detect light while the target device and inductive power apparatus are decoupled. (*See* EX1010, 595-99.) Disconnecting the relay in this fashion would have advanced Toya's goal of "prevent[ing] wasted consumption of input power." (EX1011, [0023], [0045].)

4. Claim 9

163. Toya in view of Horowitz meets each limitation of claim 9, as described below.

a. [Preamble] ***The inductive battery charging system of claim 1,***

164. Toya in view of Horowitz meets the preamble as described above for claim 1.

b. [A] ***wherein the supplemental power source is comprised of at least one of a target device battery, a charger system battery and an alternate inductive power apparatus.***

165. Toya in view of Horowitz meets this element at least as described above for claim 1, element [B]. For example, as described above, internal battery 12 comprises a charger system battery at least because it is an internal battery of battery charger 10. (EX1011, [0008].)

5. Claim 10

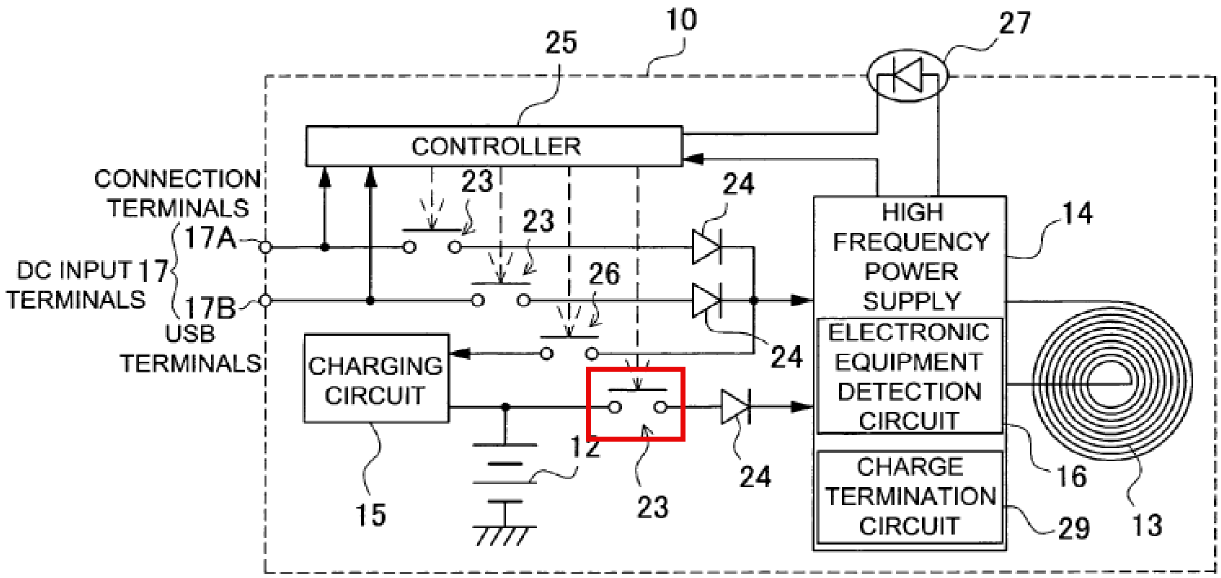
166. Toya in view of Horowitz meets each limitation of claim 10, as described below.

a. [Preamble] *The inductive battery charging system of claim 1, further comprising:*

167. Toya in view of Horowitz meets the preamble at least as described above for claim 1.

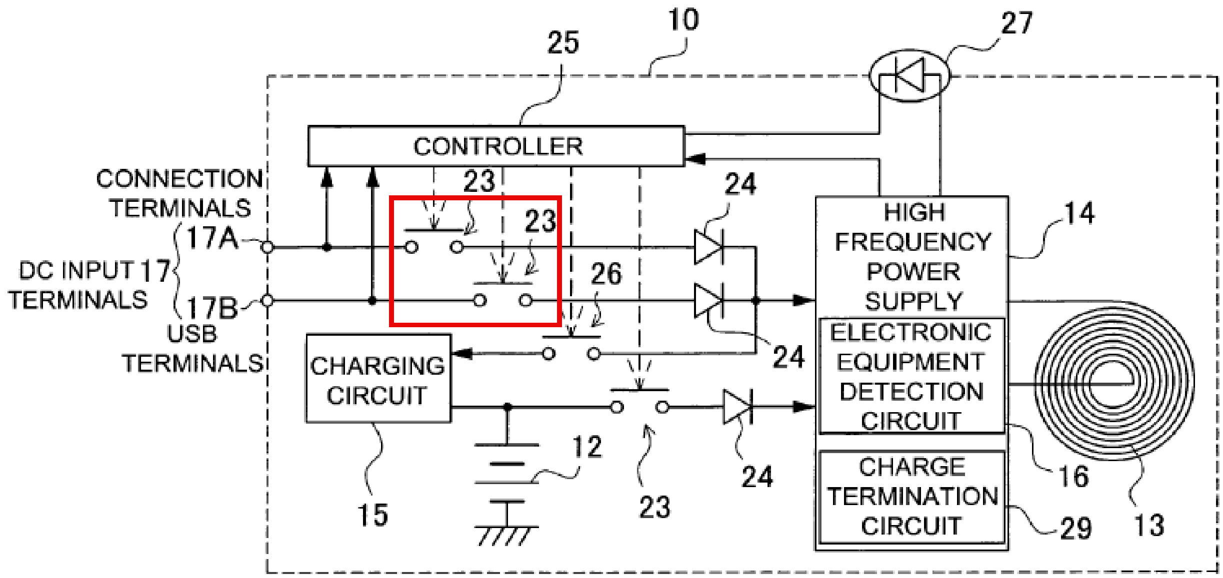
b. [A] *a bypass module to initiate a charging sequence by electrically coupling the alternating current power source and the inductive power apparatus when a bypass input is detected.*

168. Toya in view of Horowitz meets this element. Toya discloses that switches 23 can be independently turned on or off by controller 25 in order to supply DC power to the high frequency power supply 14. (EX1011, [0051].) DC power can be supplied from connection terminals 17A or 17B, and/or from internal battery 12. (EX1011, [0051]-[0054].] When the portable electronic equipment 30 is set for charging, and no DC power is input from connection terminals 17A or 17B, then controller 25 turns on the switch 23 connected to the internal battery 12 to supply power to the high frequency power supply 14 from the internal battery 12:



(EX1011, [0051]-[0054], Fig. 6 (annotated).)

169. But when the internal battery's capacity is low, controller 25 switches off the switch 23 that connects the internal battery 12 to the high frequency power supply 14. (EX1011, [0053].) At the same time, if DC power is present at the input terminals 17A/17B, controller 25 switches on the switch or switches 23 that connect the input terminals 17A/17B to the high frequency power supply 14, thus initiating a charging sequence as described above for claim 1, element [C]:



(EX1011, [0051]-[0054], Fig. 6 (annotated).)

170. The POSITA would understand the above inputs (detecting low internal battery capacity and detecting the presents of DC power at input terminals 17A/17B) to meet the claimed bypass input, *i.e.*, by directing controller 25 to bypass the internal battery 12 and instead provide power from the input terminals 17A/17B. The POSITA would further understand controller 25 and switches 23, in communication with input terminals 17A/17B, to meet the claimed bypass module, *i.e.*, by turning the appropriate switches 23 on and off to bypass the internal battery 12 and initiate a charging sequence by coupling an AC power source to the inductive power apparatus as described above for claim 1, element [C].

6. Claim 11

171. Toya in view of Horowitz meets each limitation of claim 11, as described below.

b. [Preamble] *An inductive battery charging method, comprising:*

172. Toya in view of Horowitz meets the preamble at least as described above for claim 1, [Preamble].

c. [A] *identifying whether a target device is coupled to an inductive power apparatus;*

173. Toya in view of Horowitz meets this element at least as described above for claim 1, element [A].

d. [B] *determining whether a power level of a target device battery is below a lower charging threshold while using power from a supplemental power source;*

174. Toya in view of Horowitz meets this element at least as described above for claim 1, element [B]. For example, Toya discloses detecting whether the battery 32 is below a threshold charge. (EX1011, [0022]-[0023], [0051]-[0052], [0057].)

e. [C] ***automatically engaging the inductive power apparatus and an alternating current power source when a lower available power threshold of a battery is reached;***

175. Toya in view of Horowitz meets this element at least as described above for claim 1, element [C]. To the extent not expressly disclosed, it would have been obvious to automatically reconnect Toya's inductive power apparatus to the AC power source upon reaching a lower available power threshold, such that the battery does not deplete after being decoupled.

f. [D] ***automatically decoupling the inductive power apparatus and the alternating current power source when a desired threshold power level of the target device battery is reached,***

176. Toya in view of Horowitz meets this element at least as described above for claim 1, element [D].

g. [E] ***wherein the inductive power apparatus includes at least one of a transformer to inductively generate an electric current, a rectification circuit, and a voltage regulation circuit; and***

177. Toya in view of Horowitz meets this element at least as described above for claim 1, element [F].

h. [F] ***deactivating an opto-coupled relay of the inductive power apparatus when the target device and the inductive power apparatus are decoupled.***

178. Toya in view of Horowitz meets this element at least as described above for claim 1, elements [D] and [E], and claim 2, element [A]. In addition,

Horowitz teaches that Toya's relay switches 23 can comprise an opto-coupled relay. For example, in a passage titled "Opto-couplers and relays," Horowitz describes opto-couplers (which the POSITA would understand to meet opto-coupled relays) as "very useful," and identifies numerous technical advantages, including galvanic isolation and isolation of digital noise. (EX1010, 595.) In addition to the reasons described above for claim 1, elements [C] and [D], the POSITA would be motivated to combine Toya's relays 23 with the opto-coupled relays described in Horowitz in order to realize the advantages described by Horowitz. Additionally, Horowitz provides specific instructions for integrating opto-coupled relays into electronic circuits, including circuit schematics for "nearly every kind of opto-coupler you are likely to encounter." (EX1010, 595-98, Fig. 9.26.) Thus, the POSITA would have a reasonable expectation of success in making the combination.

C. Ground 3: Claims 3-7 and 12-14 are Rendered Obvious by Toya in View of Stephens and Horowitz

179. It is my view that Toya in view of Stephens and Horowitz teaches each and every limitation of claims 3-7 and 12-14 of the '103 patent, for the reasons set forth below.

1. Claim 3

180. Toya in view of Stephens and Horowitz meets each limitation of claim 3, as described below.

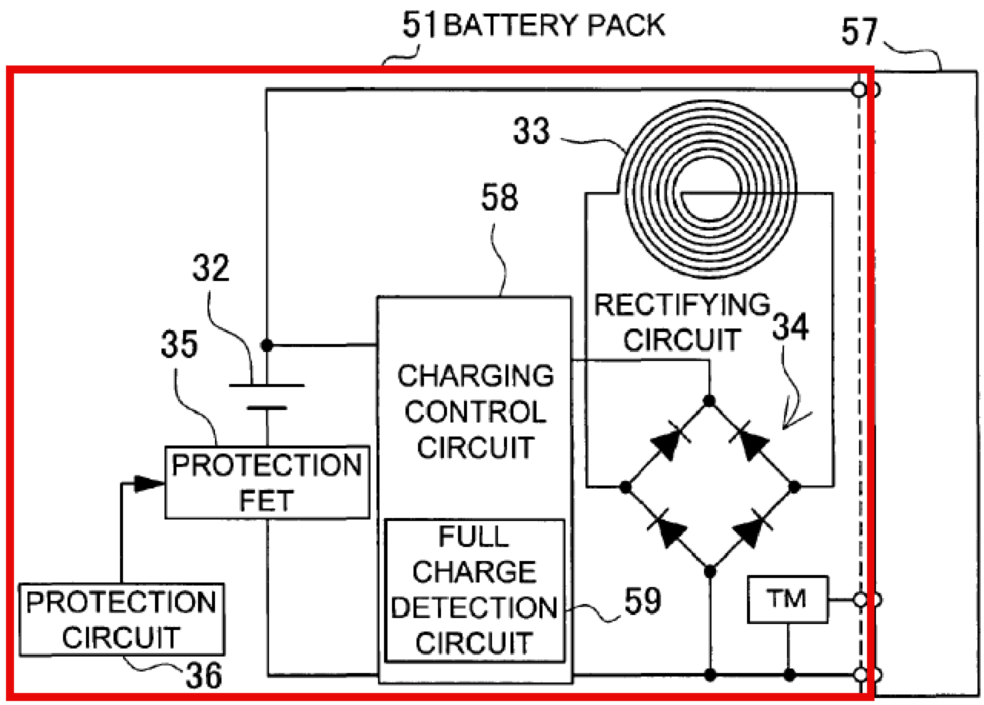
a. [Preamble] *The inductive battery charging system of claim 1, further comprising:*

181. Toya in view of Stephens and Horowitz meets the preamble as for Ground 2, claim 1.

b. [A] *a processor of the monitoring module coupled to the target device, wherein the processor is used to evaluate a target device battery power level with respect to the charging threshold.*

182. Toya in view of Stephens and Horowitz meets this element. For example, as described above, Toya discloses that full charge detection circuit 59 of battery pack 51 is coupled to battery 32, and is configured to detect whether battery 32 is fully charged:

FIG. 8



(EX1011, [0022], [0057], Fig. 8 (annotated).)

183. Toya does not expressly disclose that the full charge detection circuit 59 uses a *processor* to evaluate the power level of battery 32. However, combining the detection circuit 59 with a processor to do so would have been obvious in view of Stephens. As described above, Stephens discloses that controller 50 includes "sensing, feedback and control logic" coupled to battery 12, such that "after a threshold voltage across battery 12 is sensed," controller 50 propagates control signals to discontinue charging. (EX1009, 3:8-13, 3:20-26; 3:63-67.) This is analogous to full charge detection circuit 59 in Toya, which is coupled to battery 32 and detects a charge of battery 32. (EX1011, [0022], [0057],

Fig. 8.) Stephens further discloses that controller 50 "is preferably an Intel 8051 or like processor," and the POSITA would understand that controller 50 accordingly utilizes the processor to evaluate the battery level. (EX1009, 3:59-60.)

184. The POSITA would have been motivated to combine Toya's detection circuit 59 with the processor of Stephens' controller 50 at least because Toya is silent on implementation detail for detection circuit 59, leading the POSITA to consult other references for guidance. Stephens is analogous art because both Stephens and Toya relate to control circuits for inductive battery chargers, *e.g.*, in the context of mobile device batteries. (EX1011, [0002]; EX1009, 1:6-8.) Accordingly, the POSITA would have looked to Stephens to provide detail of how to implement a circuit that detects a battery voltage in an inductive charger. Processors such as the Intel 8051 of Stephens were specifically designed for "control applications," making them a natural fit for controlling the battery charging operations in Toya. (EX1012, 1-3.)

185. The POSITA would have been further motivated to make the combination because processors such as the Intel 8051 are small and lightweight, making them advantageous for inclusion in a battery pack for portable electronic equipment; and generally advancing Toya's goals of providing battery charging hardware that is "lightweight, thin, small, and convenient to carry." (EX1011, [0011].) Processors such as the Intel 8051 are programmable, allowing them to be

easily reconfigured—an important advantage in battery charging systems that may need to accommodate batteries having different characteristics and charging requirements. The POSITA would have been motivated to realize these advantages. And processors such as the Intel 8051 were well-understood and extensively documented, *see* EX1012, giving the POSITA a reasonable expectation of success in making the combination.

2. Claim 4

186. Toya in view of Stephens and Horowitz meets each limitation of claim 4, as described below.

a. [Preamble] *The inductive battery charging system of claim 3, further comprising:*

187. Toya in view of Stephens and Horowitz meets the preamble as described above for claim 3.

b. [A] *a battery monitor coupled to the target device to determine the target device battery power level;*

188. Toya in view of Stephens and Horowitz meets this element as described above for claim 3, element [A].

c. **[B]** ***wherein the target device is comprised of a mobile device.***

189. Toya in view of Stephens and Horowitz meets this element. For example, Toya discloses that portable electronic equipment 30 may be a portable telephone. (EX1011, [0042].)

3. Claim 5

190. Toya in view of Stephens and Horowitz meets each limitation of claim 5, as described below.

a. **[Preamble]** ***The inductive battery charging system of claim 1, further comprising:***

191. Toya in view of Stephens and Horowitz meets the preamble as for Ground 2, claim 1.

b. **[A]** ***a sense feedback loop of the connection module to identify whether the target device is coupled with at least one of the inductive power apparatus and the alternating current power source;***

192. Toya in view of Stephens and Horowitz meets this element. For example, as discussed above for Ground 2, claim 1, element [A], Toya discloses a sense feedback loop at least via controller 25, which detects (*e.g.*, via electronic equipment detection circuit 16) an electronic equipment data signal induced in the primary coil 13 to determine that the portable electronic equipment 30 is "set in

position for charging," which the POSITA would understand to mean coupled with primary coil 13 of the battery charger. (EX1011, [0045], [0051]-[0052].)

c. **[B]** ***an input buffer of the connection module to receive a feedback signal; and***

193. Toya in view of Stephens and Horowitz meets this element. It would have been obvious to the POSITA to implement controller 25 using a processor, such as the Intel 8051, as taught by Stephens. The POSITA would have been motivated to make the combination, and had a reasonable expectation of success in doing so, for reasons analogous to those discussed above for claim 3, element [A]. That is, Toya provides limited implementation detail of controller 25, leading the POSITA to look to Stephens, and its description of using an Intel 8051 processor to implement an inductive battery charger controller, for guidance.

194. It further would have been obvious for controller 25 to receive the electronic equipment data signal (*e.g.*, via an output of electronic equipment detection circuit 16) using one of the general purpose input ports of the processor, because receiving data signals is the intended function of the input ports. (EX1012, 3-6–3-8.) And further, the processor's input ports meet the claimed input buffer for the same reasons discussed for Ground 1, claim 5, element [B]. (EX1001, 12:20-22, 14:60-64; EX1012, 1-3.)

d. [C] *an interrupt controller module to generate an interrupt signal determined by the feedback signal received by the input buffer.*

195. Toya in view of Stephens and Horowitz meets this element. For example, as discussed above, Toya discloses that controller 25 responds to the electronic equipment data signal by controlling switches 23, to couple or decouple input power from the high frequency power supply 14. (EX1011, [0051]-[0054].) As discussed above for element [B], it would have been obvious for controller 25 to be implemented using an Intel 8051 processor; controller 25 thus meets the interrupt controller module, and the control signals provided by controller 25 to switches 23 meet the claimed interrupt signal, for the same reasons discussed for Ground 1, claim 5, element [C] with respect to Stephens' controller 50. (EX1001, 12:1-4; EX1012, 1-20–1-22, 2-12–2-13, 3-23–3-25.)

(i) Means-Plus-Function

196. If *interrupt controller module* is interpreted as a means-plus-function limitation, this element is met because Toya in view of Stephens and Horowitz teaches the recited function and its corresponding structure. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. With respect to structure, the '103 patent discloses that the interrupt controller module responds to a logic state change on the input buffer, which is a GPIO input port, by causing a processor to initiate an ISR. (EX1001, 12:1-4, 14:60-64.) This is met at least equivalently by

controller 25; as described above, it would have been obvious to implement controller 25 using an Intel 8051 processor, which includes interrupt sources that can generate an interrupt signal and enter an interrupt service routine based on, *e.g.*, changes in logic signals received at a GPIO input port, *e.g.*, an INTx pin. (EX1009, 3:59-60; EX1012, 1-20–1-22, 2-12–2-13, 3-23–3-25.)

4. Claim 6

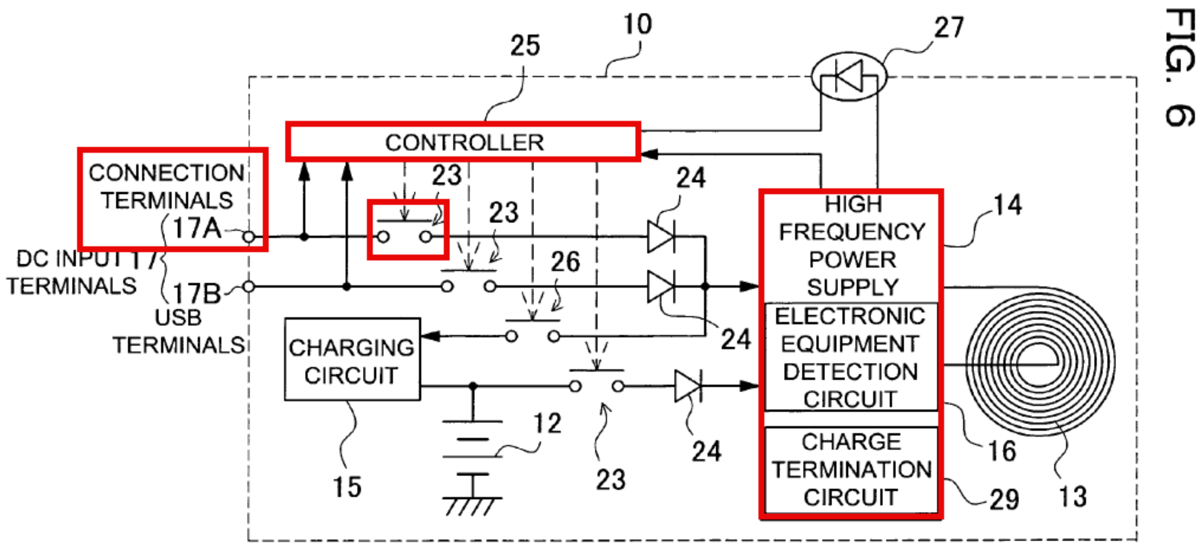
197. Toya in view of Stephens and Horowitz meets each limitation of claim 6, as described below.

a. [Preamble] *The inductive battery charging system of claim 4, further comprising:*

198. Toya in view of Stephens and Horowitz meets the preamble as described above for claim 4.

b. [A] *an output buffer to generate an engage signal to control a coupling state of the inductive power apparatus and the alternating current power source.*

199. Toya in view of Stephens and Horowitz meets this element. As discussed above, Toya's controller 25 provides control signals to switches 23, thereby controlling a coupling state of the AC adapter terminals 17A and the high frequency power supply 14:



(EX1011, [0051]-[0052], Fig. 6 (annotated).)

200. As discussed above for claims 3 and 5, it would have been obvious to implement Toya's controller 25 using a processor, such as the Intel 8051, such as taught by Stephens with respect to its controller 50. It would have been obvious for Toya's controller 25 to provide control signals to switches 23 using a general purpose output port, because outputting data signals is the intended function of the output ports. (EX1012. 3-6–3-8.) The processor's output port meets the claimed output buffer for the same reasons discussed for Ground 1, claim 6, element [A]. (EX1001, 12:20-22, 15:23-26; EX1012, 1-3.)

5. Claim 7

201. Toya in view of Horowitz meets each limitation of claim 7, as described below.

a. [Preamble] ***The inductive battery charging system of claim 4, further comprising:***

202. Toya in view of Horowitz meets the preamble as described above for claim 4.

b. [A] ***a USB module to generate an engage signal to control the coupling state of the inductive power apparatus and the alternating current power source.***

203. Toya in view of Horowitz meets this element. For example, Toya discloses that "When DC power is input from either the AC adapter connection terminals 17A or the USB terminals 17B, the controller 25 switches ON the switch 23 connected to the terminals with the DC power to input that power to the high frequency power supply 14." (EX1011, [0052].) The POSITA would thus understand Toya to teach that controller 25 receives an engage signal (DC power) from a USB module (USB terminals 17B) to control the coupling state of the inductive power apparatus and the alternating current power source. For example, by disclosing that "the controller 25 switches ON the switch 23 connected to the terminals with the DC power," Toya teaches switching ON the switch 23 connected to the USB terminals 17B. And because Toya discloses controlling switches 23 "to input *that power*"—*i.e.*, only the DC power from the USB terminals 17B—to the high frequency power supply 14, Toya teaches accordingly

switching OFF the switch 23 connected to the AC adapter connection terminals 17A.

(i) Means-Plus-Function

204. If *USB module* is interpreted as a means-plus-function limitation, this element is met because Toya in view of Horowitz teaches the recited function and its corresponding structure. (*See* ¶30.) The recited function (*see* ¶30) is met as described above. With respect to structure, Toya discloses two USB terminals 17B that may connect to a USB cable; the terminals provide USB signals that supply DC power to the high frequency power supply 14 via relays 23. (EX1011, [0046]-[0047], Fig. 6.) The USB signals are also provided to controller 25, which uses the USB signals to control the relays. (EX1011, [0052], Fig. 6.) With respect to this proceeding, the POSITA would understand this to be equivalent to the '103 patent's disclosure of the USB module, *e.g.*, using a USB interface as "a battery charge port on a cell phone or other mobile device"; providing USB power and ground signals to the inductive charger apparatus; and providing control signals to the separation module 334 and the relay 462. (EX1001, 12:61-13:7.) The POSITA would further understand the USB signals of Toya to adhere to the USB specification, *e.g.*, to provide the USB signals as disclosed in the '103 patent. (*See, e.g.*, EX1014, 17, 94.)

6. Claim 12

205. Toya in view of Stephens and Horowitz meets each limitation of claim 12, as described below.

a. [Preamble] ***The inductive battery charging method of claim 11,***

206. Toya in view of Horowitz meets the preamble as described for Ground 1, claim 11.

b. [A] ***wherein the power level of the target device battery is determined using a processor and a battery monitor, and***

207. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 4, element [A].

c. [B] ***wherein the target device is comprised of a mobile device coupled to the processor and the battery monitor.***

208. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 4, element [B].

7. Claim 13

209. Toya in view of Stephens and Horowitz meets each limitation of claim 13, as described below.

a. [Preamble] ***The inductive battery charging method of claim 12, further comprising:***

210. Toya in view of Stephens and Horowitz meets the preamble as described above for claim 12.

b. [A] ***identifying a coupling of the inductive power apparatus and the target device using a sense feedback loop;***

211. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 5, element [A].

c. [B] ***receiving a feedback signal using an input buffer;***

212. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 5, element [B].

d. [C] ***transmitting an interrupt signal determined in accordance with the feedback signal received by the input buffer; and***

213. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 5, element [C].

e. [D] ***adapting a coupling state of the inductive power apparatus and the alternating current power source based on the interrupt signal.***

214. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 5, elements [B] and [C].

8. Claim 14

215. Toya in view of Stephens and Horowitz meets each limitation of claim 14, as described below.

a. [Preamble] *An inductive battery charging system, comprising:*

216. Toya in view of Stephens and Horowitz meets the preamble at least as described above for Ground 2, claim 1 [Preamble].

b. [A] *a connection module to confirm whether a target device is coupled to an inductive power apparatus, wherein the inductive power apparatus is comprised of a transformer and the target device is comprised of a mobile device;*

217. The claimed connection module is met as for Ground 2, claim 1, element [A]. (EX1007, ¶TBD.) The inductive power apparatus is comprised of a transformer, *e.g.*, primary coil 13 inductively coupled to secondary coil 33. (EX1011, [0008]; EX1007, ¶TBD.) The portable electronic equipment 30 may be a portable telephone. (EX1011, [0042]; EX1007, ¶TBD.)

c. [B] *a sense feedback loop of the connection module to identify whether the target device is coupled to an alternating current power source using at least one of a sense feedback signal and a power transmitted from the alternating current power source to the target device;*

218. Toya in view of Stephens and Horowitz meets this element as described above for claim 5, element [A].

d. [C] ***a monitoring module to detect whether a target device battery is below a charging threshold while using power from a supplemental power source;***

219. Toya in view of Stephens and Horowitz meets this element at least as described above for Ground 2, claim 1, element [B].

e. [D] ***a battery monitor coupled to the target device to determine a target device battery power level;***

220. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 3, element [A].

f. [E] ***a processor of the monitoring module coupled to the target device, wherein the processor is used to evaluate the target device battery power level with respect to the charging threshold;***

221. Toya in view of Stephens and Horowitz meets this element at least as described above for claim 3, element [A].

g. [F] ***an activation module to automatically couple the target device and the alternating current power source using the inductive power apparatus when the target device battery is below the charging threshold; and***

222. Toya in view of Stephens and Horowitz meets this element at least as described above for Ground 2, claim 1, element [C].

h. [G] ***a separation module to automatically decouple the target device and the alternating current power source when a desired charging state of the target device battery is detected by the monitoring module,***

223. Toya in view of Stephens and Horowitz meets this element at least as described above for Ground 2, claim 1, element [D].

i. [H] ***wherein the separation module is comprised of an opto-coupled relay.***

224. Toya in view of Stephens and Horowitz meets this element at least as described above for Ground 2, claim 11, element [F].

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 26th of June, 2025 in Los Angeles, California.

Respectfully submitted,

Michael S. Chen