



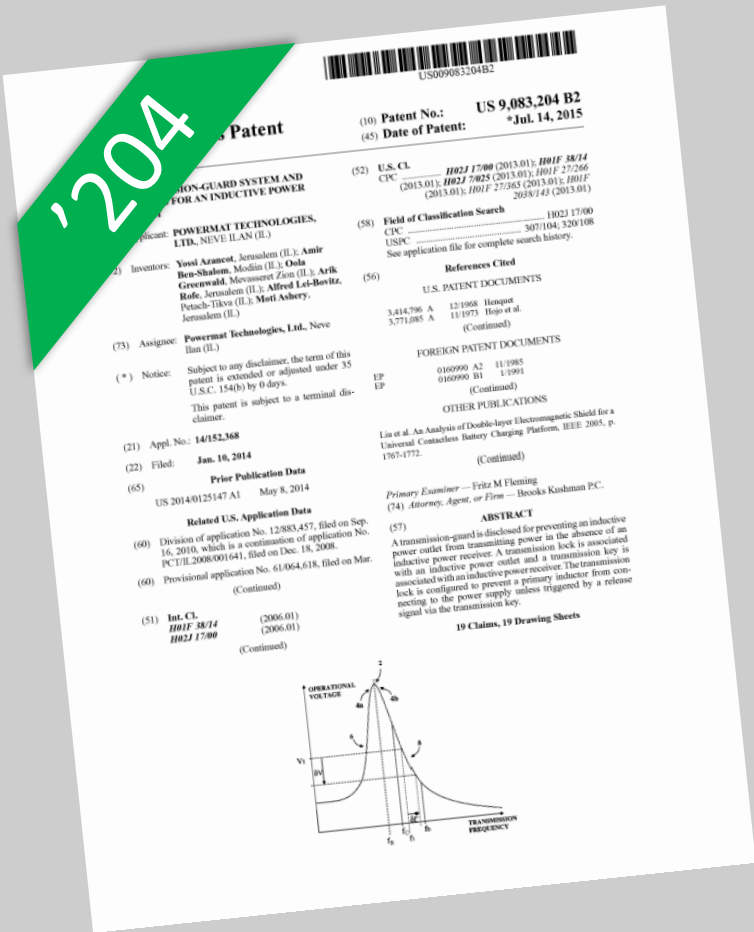
PATENT OWNER'S HEARING DEMONSTRATIVES

Anker Innovations Ltd., v. Powermat Technologies Ltd.

IPR2024-00995

U.S. Patent No. 9,083,204

November 18, 2025



TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY U.S. PATENT NO. 9,083,204

'204 PATENT OVERVIEW

Patent No.: US 9,083,204 B2

Date of Patent: *Jul. 14, 2015

TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY

Related U.S. Application Data

Division of application No. 12/883,457, filed on Sep. 16, 2010, which is a continuation of application No. PCT/IL2008/001641, filed on Dec. 18, 2008.

Provisional application No. 61/064,618, filed on Mar. 17, 2008, provisional application No. 61/071,151, filed on Apr. 15, 2008, provisional application No. 61/129,526, filed on Jul. 2, 2008, provisional application No. 61/129,859, filed on Jul. 24, 2008, provisional application No. 61/129,970, filed on Aug. 4, 2008.

(12) **United States Patent**
Azancot et al.

(10) **Patent No.:** US 9,083,204 B2
(45) **Date of Patent:** *Jul. 14, 2015

(54) **TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY**

(71) Applicant: **POWERMAT TECHNOLOGIES, LTD., NEVE ILAN (IL)**

(72) Inventors: **Yossi Azancot, Jerusalem (IL); Amir Ben-Shalom, Modin (IL); Oda Greenwald, Mevaseret Zion (IL); Arlik Rofe, Jerusalem (IL); Alfred Lei-Bovitz, Petach-Tikva (IL); Moti Ashery, Jerusalem (IL)**

(73) Assignee: **Powermat Technologies, Ltd., Neve Ilan (IL)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/152,368**

(22) Filed: **Jan. 10, 2014**

(65) **Prior Publication Data**
US 2014/0125147 A1 May 8, 2014

Related U.S. Application Data
(66) Division of application No. 12/883,457, filed on Sep. 16, 2010, which is a continuation of application No. PCT/IL2008/001641, filed on Dec. 18, 2008.

(60) Provisional application No. 61/064,618, filed on Mar. (Continued)

(51) **Int. CL**
H01F 38/14 (2006.01)
H02J 17/00 (2006.01)
(Continued)

(52) **U.S. CL**
CPC **H02J 17/00** (2013.01); **H01F 38/14** (2013.01); **H02J 7/025** (2013.01); **H01F 27/266** (2013.01); **H01F 27/365** (2013.01); **H01F 2058/143** (2013.01)

(58) **Field of Classification Search**
CPC **H02J 17/00**
USPC **307/104; 320/108**
See application file for complete search history.

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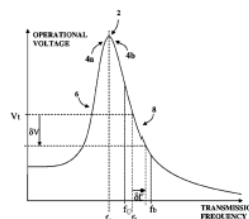
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(Continued)

Primary Examiner — Fritz M Fleming
(74) **Attorney, Agent, or Firm** — Brooks Kushman P.C.

(57) **ABSTRACT**
A transmission-guard is disclosed for preventing an inductive power outlet from transmitting power in the absence of an inductive power receiver. A transmission lock is associated with an inductive power outlet and a transmission key is associated with an inductive power receiver. The transmission lock is configured to prevent a primary inductor from connecting to the power supply unless triggered by a release signal via the transmission key.

19 Claims, 19 Drawing Sheets



EX1001

Overview of U.S. Patent No. 9,083,204



PROBLEM

- A need exists “for a practical inductive power transfer system for safely and conveniently delivering power wirelessly from inductive power outlets to inductive power receivers in an energy efficient manner.” EX1001 at 2:35-38.
- “[P]rior art systems . . . ‘typically transmit power at the resonant frequency of the inductive coupling,’ which ‘can be difficult to maintain, as the resonant frequency of the system may fluctuate during power transmission, for example in response to changing environmental conditions or variations in alignment between primary and secondary coils.’” EX2009 at ¶ 51 (quoting EX1001 at 19:65-20:3); *see also* POR at 2-7 (Paper 12).

Overview of U.S. Patent No. 9,083,204



SOLUTION

- A transmission frequency f_t is selected to lie within the near-linear region of a frequency-amplitude curve, substantially different from the resonance frequency f_R (or peak) of the inductive couple. EX2009 at ¶ 52; *see also* EX1001 at 21:20-23, 56-57; POR at 2 (Paper 12).
- Near-linear operation is achieved by transmitting a driving voltage which oscillates at a transmission frequency substantially different from the resonant frequency of the inductive couple. EX2009 at ¶ 54; *see also* EX1001 at 21:17-20; POR at 3-4 (Paper 12).
- The transmission frequency may be used to regulate power transfer. EX1001 at 21:47-49; *see also* EX2009 at ¶ 56; POR at 4 (Paper 12).

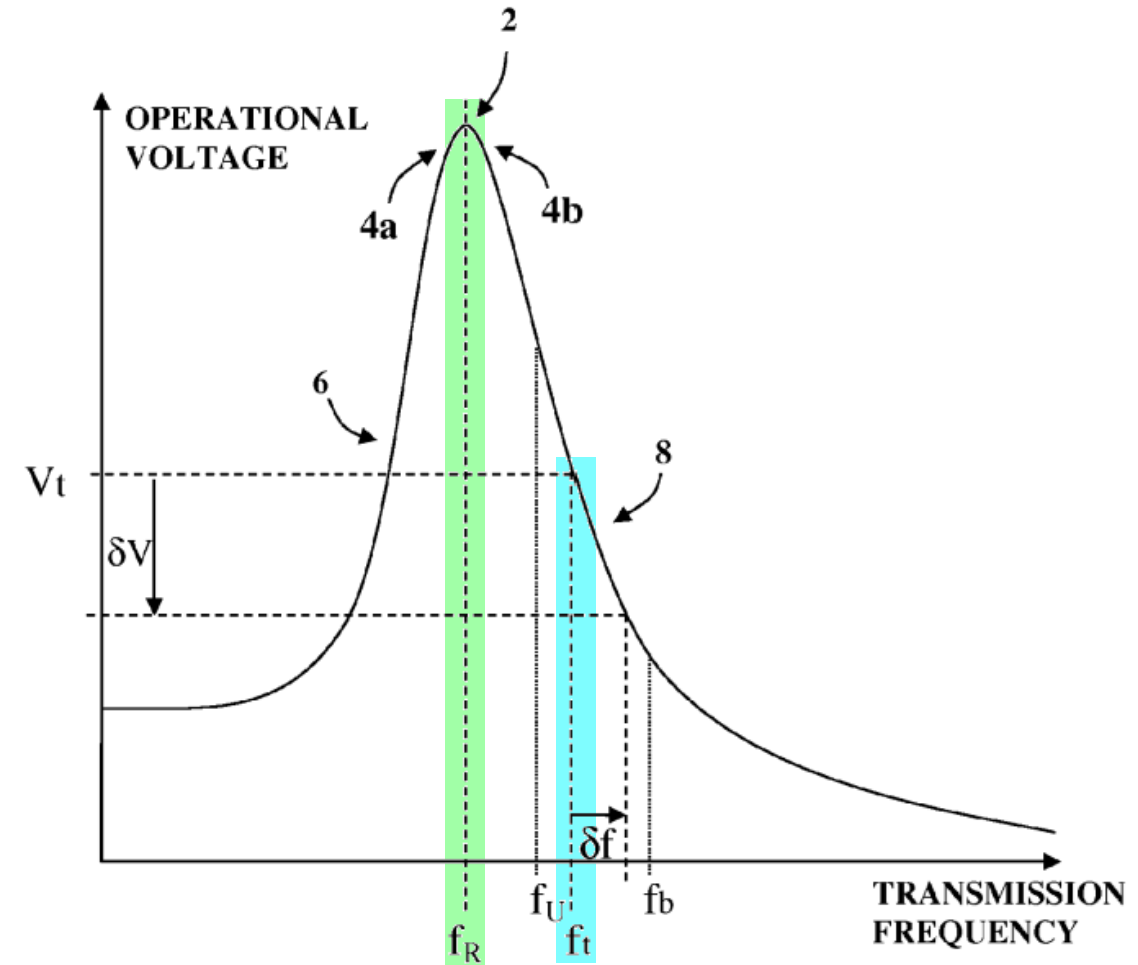


Fig. 6b

EX1001 at Fig. 6b (annotated); *see also* POR at 3 (Paper 12).

Overview of U.S. Patent No. 9,083,204

SOLUTION



**Patrick Mercier,
Ph.D.**

57. For example, the improved driver in the '204 Patent's proposed power outlet "may be configured to adjust the transmission frequency [in a linear or near-linear manner] in order to [predictably] regulate the power transfer." *Id.* at 21:53-55. In other words, the '204 Patent discloses a linear control technique for regulating power transfer in which "[t]he induced voltage can be increased by reducing the transmission frequency and can be reduced by increasing the transmission frequency." *Id.* at 21:61-63; *see also id.* at 21:63-65 (explaining that "an increase in transmission frequency of δf produces a decrease in induced voltage of δV "), Claim 1 (28:25-45), Claim 10 (29:17-32); Claim 13 (29:44-52).

58. A POSITA would appreciate that a linear control system is significantly easier to design and operate than one based on non-linear dynamics. Linear control systems operate predictably: if one parameter increases, for example, a corresponding parameter may go down by a linear, predictable amount. In a non-linear control system, if one parameter increases, for example, the corresponding parameter may go down, but not by a linear, easily predictable amount. This significantly complicates control system design and, importantly, makes determination and achievement of control loop performance and stability much more difficult. Control systems employed in systems like wireless charging need to be stable in order to operate reliably and not overheat or breakdown, as may occur in an unstable system. For these reasons, designers often prefer to design linear control systems when possible.

EX2009 at ¶¶ 57-58; *see also* POR at 4-5 (Paper 12).

Claim 1

CLAIM 1
[1.P] An inductive power transfer system comprising
[1.1] at least one inductive power outlet comprising at least one primary inductive coil wired to a power supply via a driver;
[1.2] said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,
[1.3] said secondary inductive coil associated with an inductive power receiver
[1.4] wherein said driver is configured to provide a driving voltage across said primary inductive coil,
[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,
[1.6] wherein said inductive power outlet further comprises a signal detector adapted to detect a first signal and a second signal, and
[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and
[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Claim 2

CLAIM 2

The system of claim 1 said signal detector being configured to adjust said transmission frequency in response to feedback signals.

Claim 3

CLAIM 3

The system of claim 2 wherein said feedback signals carry data pertaining to the operational parameters of said electric load.

Claim 4

CLAIM 4

The system of claim 3 wherein said operational parameters are selected from the group consisting of:

- required operating voltage for said electric load;
- required operating current for said electric load;
- required operating temperature for said electric load;
- required operating power for said electric load;
- measured operating voltage for said electric load;
- measured operating current for said electric load;
- measured operating temperature for said electric load;
- measured operating power for said electric load;
- power delivered to said primary inductive coil;
- power received by said secondary inductive coil; and
- a user identification code.

Claim 5

CLAIM 5

The system of claim 1 wherein said signal detector is selected from the list comprising optical detectors, radio receivers, audio detectors and voltage peak detectors.

Claim 6

CLAIM 6

The system of claim 1 wherein said driver further comprises a voltage monitor for monitoring the amplitude of a primary voltage across said primary coil.

Claim 8

CLAIM 8

The system of claim 1 comprising a power converter selected from the group comprising: a transformer, a DC-to-DC converter, an AC-to-DC converter, an AC-to-AC converter, a flyback transformer, a flyback converter, a full-bridge converter, a half-bridge converter and a forward converter.

Claim 10

CLAIM 10
[10.P] A method for regulating inductive power transmission from a primary inductive coil, wired to a power supply via a driver, to a secondary inductive coil, wired to an electric load, said method comprising the following steps:
[10.1] providing an oscillating voltage to said primary inductive coil at an initial transmission frequency f_t substantially different from a characteristic resonant frequency f_R of the system;
[10.2] inducing a secondary voltage in said secondary inductive coil;
[10.3] monitoring power received by said electric load;
[10.4] sending a feedback signal when the monitored power deviates from a predetermined range;
[10.5] said driver receiving said feedback signal; and
[10.6] said driver adjusting said non-resonant transmission frequency.

Claim 11

CLAIM 11

The method of claim 10 wherein the step of sending a feedback signal further comprises: sending a feedback signal of a first type S_a to said driver, whenever said power drops below a predetermined lower threshold, and sending a feedback signal of a second type S_b to said driver, whenever said power exceeds a predetermined upper threshold.

Claim 12

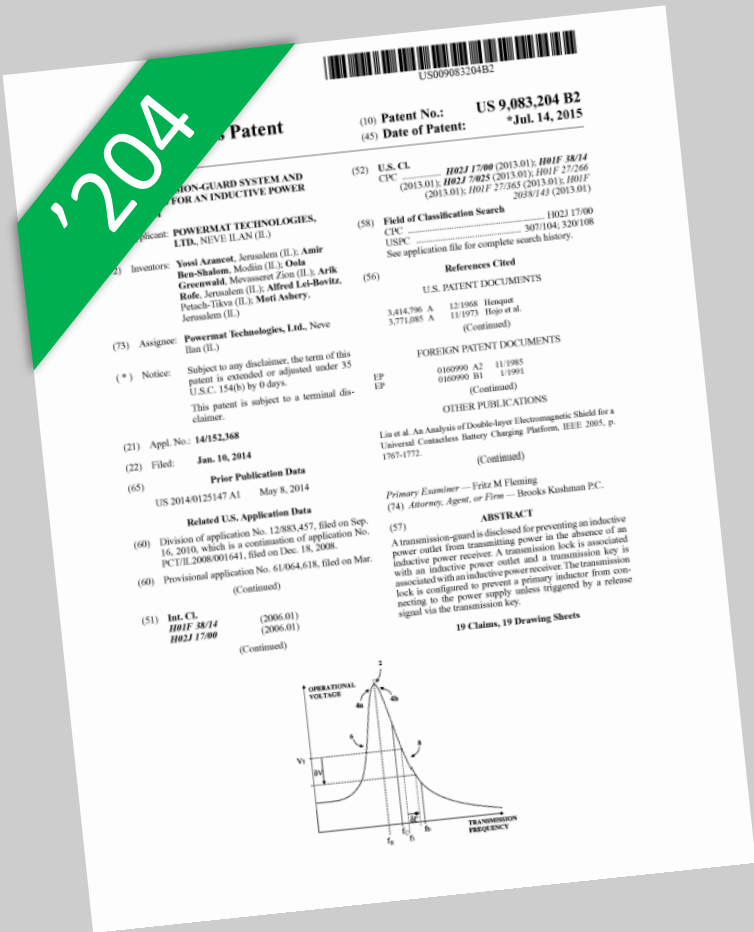
CLAIM 12

The method of claim 10 wherein said initial non-resonant transmission frequency f_t is higher than the characteristic resonant frequency f_R .

Claim 13

CLAIM 13

The method of claim 10 wherein the step of said driver adjusting said non-resonant transmission frequency further comprises: said driver reducing said non-resonant transmission frequency by an incremental value df_1 when the received feedback signal is of the first type S_a , and said driver increasing said non-resonant transmission frequency by an incremental value $+df_2$ when the received feedback signal is of the second type S_b .



TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY U.S. PATENT NO. 9,083,204

'204 CLAIM CONSTRUCTION

“Substantially Different”

Patent Owner’s Construction

“[A] POSITA would define . . . ‘transmission frequenc[ies] [that are] substantially different from [the] characteristic resonant frequency,’ to: (1) encompasses frequencies that lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple, and (2) allow for some incremental change (increase or decrease) in frequency while remaining in one of the near-linear regions of the frequency-amplitude graph. A POSITA would further appreciate that (3) a system that has the equivalent of a pick-up frequency that is at or near the resonant frequency is distinguishable from claims 1 and 10 of the ‘204 Patent.” POR at 27-28 (Paper 12) (citing EX2009 at ¶ 113).

Petitioner’s Construction

“[R]egardless of the outermost boundaries of the scope of a transmission frequency ‘substantially different’ from a characteristic resonant frequency as claimed, the specification plainly establishes that it must at least encompass the frequencies within one of the near-linear regions of the frequency-amplitude graph.” Pet. at 9 (Paper 2).

The Dispute:

Whether the term “substantially different” allows for incremental change in frequency while remaining in one of the near-linear regions of the frequency-amplitude graph.

The Board's Preliminary Construction

On this record and for purposes of this decision, we determine that—consistent with the Specification's description of the frequency that is “[p]referably . . . selected” and applicant's argument regarding the same during prosecution—“a non-resonant transmission frequency *substantially different* from said characteristic resonant frequency of said inductive couple” encompasses frequencies that lie within one of the near-linear regions of a frequency-amplitude graph associated with the inductive couple. *See* Ex. 1001, 21:20–24; Ex. 1002, 62. At this time and for purposes of this Decision, we need not and do not reach the issue of the outer bounds of the scope of “substantially different.”

Decision Granting Institution at 26 (Paper 7).

Intrinsic Evidence Supports Patent Owner's Construction of "Substantially Different"

It is another aim of the invention to present an inductive power transfer system comprising at least one inductive power outlet comprising at least one primary inductive coil wired to a power supply via a driver; the primary inductive coil for forming an inductive couple with at least one secondary inductive coil wired to an electric load, the secondary inductive coil associated with an inductive power receiver wherein the driver is configured to provide a driving voltage across the primary inductive coil, the driving voltage oscillating at a transmission frequency significantly different from the resonant frequency of the inductive couple. Optionally, the driver comprises a switching unit for intermittently connecting the primary inductive coil to the power supply.

Preferably, the transmission frequency lies within a range in which induced voltage varies approximately linearly with frequency. Optionally, the driver is configured to adjust the transmission frequency in response to the feedback signals.

EX1001 at 4:1-17; *see also* POR at 24-25 (Paper 12)

Intrinsic Evidence Supports Patent Owner's Construction of "Substantially Different"

Referring back to FIG. 6b, the frequency of transmission is selected to be in the approximately linear region 8 of the curve between a lower frequency value of f_L , and an upper frequency value of f_U . A transmission frequency f_t , higher than the resonant frequency f_R of the system, produces an induced voltage of V_t . The induced voltage can be increased by reducing the transmission frequency and can be reduced by increasing the transmission frequency. For example, an increase in transmission frequency of δf produces a decrease in induced voltage of δV .

EX1001 at 21:56-65; see also POR at 25 (Paper 12)

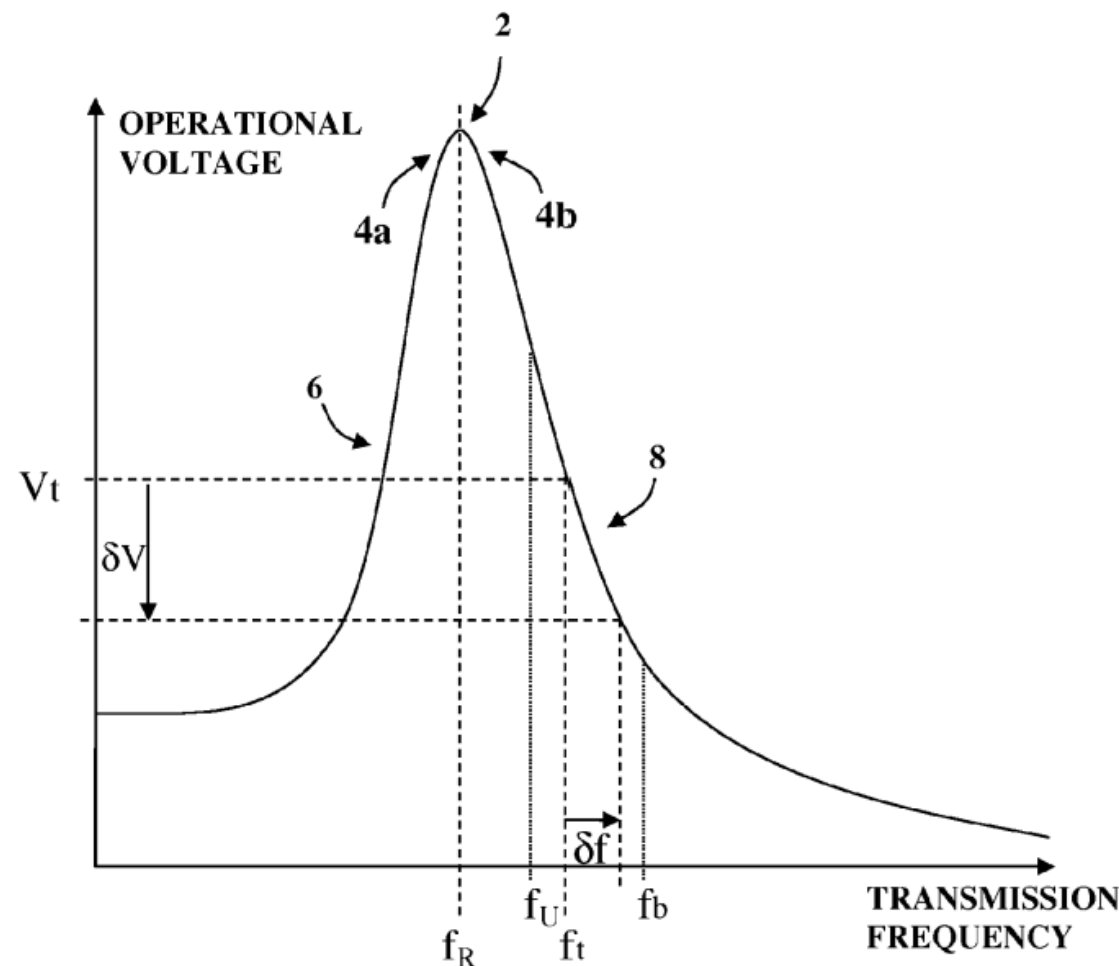


Fig. 6b

EX1001 at Fig. 6b; see also POR at 26 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Substantially Different"



**Patrick Mercier,
Ph.D.**

While the '204 Patent does not use the phrase "linear regulation" or "linear control," a POSITA would understand this benefit as a central aim of the '204 Patent. . . Figure 6d in the '204 patent then goes on to explain the power regulation method, showing that the power monitor monitors the power received by the electrical load, and uses this signal in a feedback loop to adjust the operational frequency by incremental amounts. A POSITA would understand this as a classic linear regulation scheme, and a key aim of the '204 patent.

EX2009 at ¶ 112; *see also* POR at 25 (Paper 12).

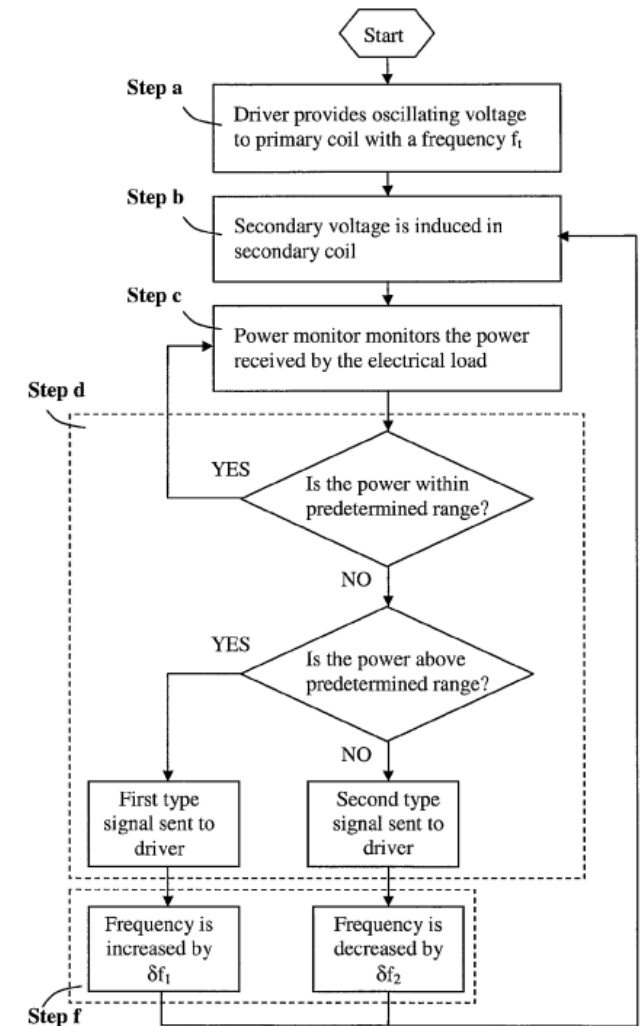


Fig. 6d

EX1001 at Fig. 6d; *see also* POR at 6 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Substantially Different"

Referring back to FIG. 6b, the frequency of transmission is selected to be in the approximately linear region 8 of the curve between a lower frequency value of f_L , and an upper frequency value of f_U . A transmission frequency f_t higher than the resonant frequency f_R of the system, produces an induced voltage of V_t . The induced voltage can be increased by reducing the transmission frequency and can be reduced by increasing the transmission frequency. For example, an increase in transmission frequency of δf produces a decrease in induced voltage of δV .

EX1001 at 21:56-67; POR at 25 (Paper 12).

One example of a power regulation method using simple feedback signals is shown in the flowchart of FIG. 6d. The method involves the following steps: (a) The driver 6230 provides an oscillating voltage at a transmission frequency f_t , which is higher than the resonant frequency f_R of the system; (b) A secondary voltage is induced in the secondary coil 6320; (c) A power monitor in the secondary unit 6300, monitors the power received by the electric load 6340; (d) If the power received by the electric load 6340 lies within a predetermined range then no action is taken. If the power received by the electric load E340 is below the predetermined range, then a feedback signal of a first type S_a is sent to the driver. If the power received by the electric load 6340 is above the predetermined range, then a feedback signal of a second type S_b is sent to the driver; (e) A feedback signal is received by the driver 6230; (f) If the received feedback signal is of the first type S_a , then the transmission frequency is increased by an incremental value $+\delta f_1$. If the received feedback signal is of the second type S_b , then the transmission frequency is decreased by an incremental value $-\delta f_2$.

EX1001 at 22:45-64; POR at 25 (Paper 12)

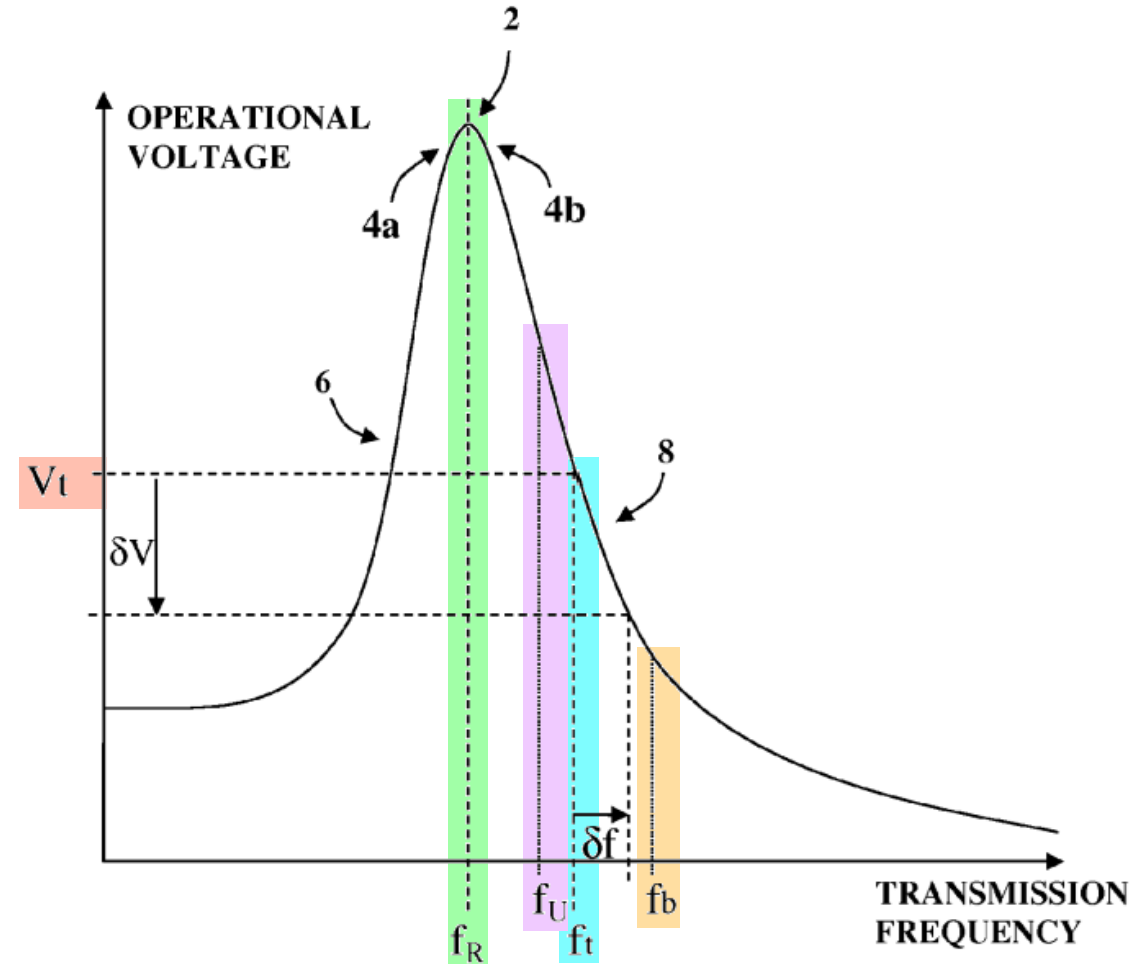


Fig. 6b

EX1001 at Fig. 6b; POR at 26 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Substantially Different"

100. Notably, a POSITA would understand that frequency f_U on Figure 6b is the lower bound frequency in the approximately linear region 8, which also corresponds to the frequency that yields the upper bound of the operational voltage, while frequency f_b on Figure 6b is the upper bound frequency in the approximately linear region 8, which also corresponds to the frequency that yields the lower bound of the operational voltage. A POSITA would understand that f_L and f_b may be regarded as referring to the same thing and may be used interchangeably.

EX2009 at ¶ 101; *see also* POR at 26 (Paper 12).

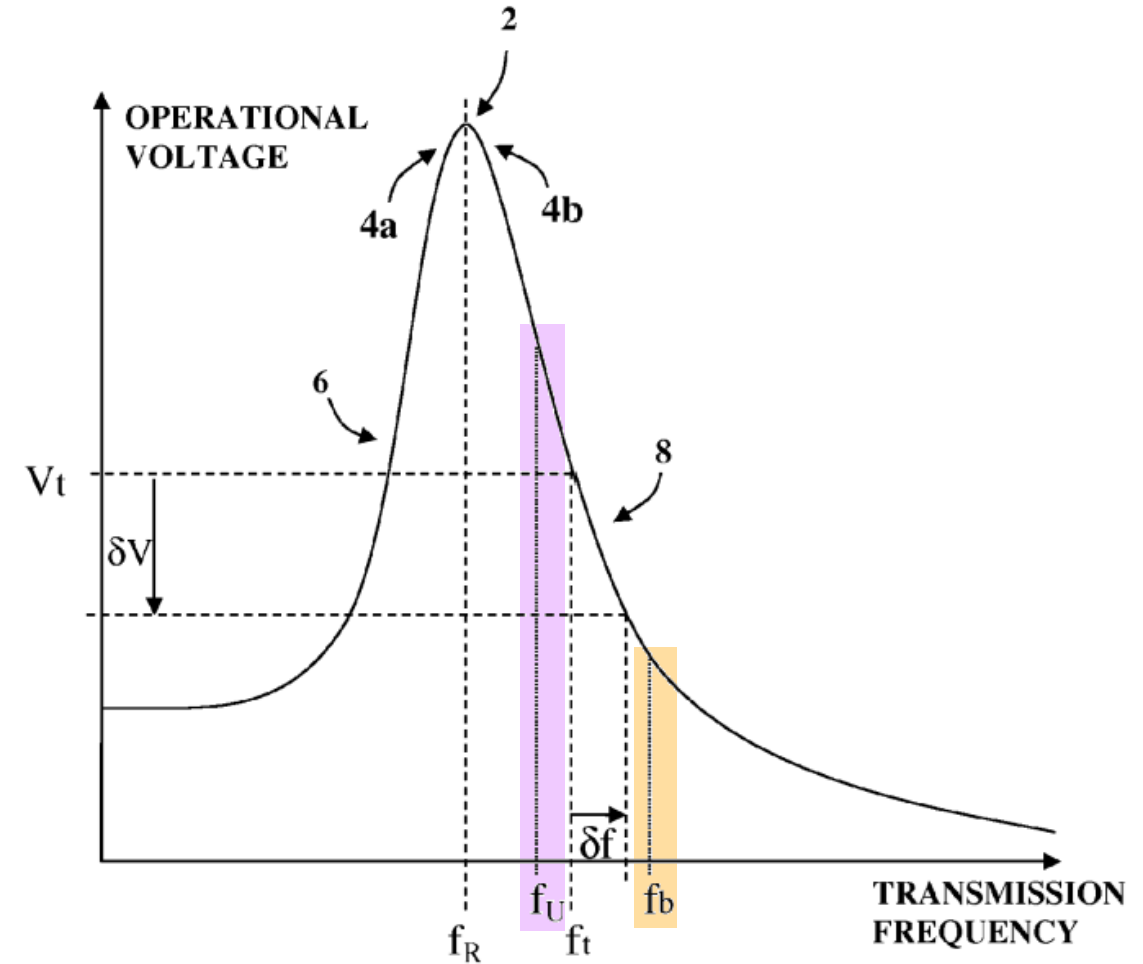


Fig. 6b

EX1001 at Fig. 6b; *see also* POR at 26 (Paper 12).

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.



**Patrick Mercier,
Ph.D.**

Reading Claim 1 as a Whole

[T]he driver is configured to increase/decrease the non-resonant transmission frequency that is substantially different from said characteristic resonant frequency of said inductive couple (*i.e.*, a frequency that lies within the near-linear region of a frequency-amplitude graph). In reading claim 1 as a whole, a POSITA would understand that the '204 Patent is directed to a linear control technique for predictably regulating power transfer.

EX2009 at ¶ 102; *see also* POR at 27 (Paper 12).

“Incremental Value”

Patent Owner’s Construction	Petitioner’s Construction
“‘[P]rovide [less/more] power by [increasing/decreasing] said non-resonant transmission frequency by an <u>incremental value</u> ’ and ‘[reducing/increasing] said non-resonant transmission frequency by an <u>incremental value</u> [df1/+df2]’ should be interpreted consistent with their plain and ordinary meanings. That is, a POSITA would understand that incremental adjustments to a transmission frequency excludes simply selecting a discrete transmission frequency value.” POR at 34 (Paper 12) (citing EX2009 at ¶¶ 115-131).	“PO attempts to import multiple unrecited limitations into claims 1 and 13 by loading term ‘incremental value’ with meaning that is both inconsistent with the breadth of the plain language of the claims and unsupported by the specification.” PR at 3-4.

The Dispute:

Whether the term “incremental value” excludes simply selecting a discrete transmission frequency value but rather requires a series of small adjustments.

The Board's Preliminary Construction

Thus, even if a given construction would result in the term “incremental” having little patentable weight, that appears, at this preliminary stage and on the current limited record, to be due to how the claim is drafted rather than as a result of reading out the term, as Patent Owner implies. *SimpleAir, Inc. v. Sony Ericsson Mobile Commc 'ns AB*, 820 F.3d 419, 429 (Fed. Cir. 2016) (“The preference for giving meaning to all terms . . . is not an inflexible rule that supersedes all other principles of claim construction.”). At this early stage of the proceeding, we do not agree with Patent Owner’s interpretation of “incremental value” and we decline to read into the claim concepts such as a repeating feedback loop, a series of adjustments, and the exclusion of the selection of “discrete frequency values.” *See Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 913 (Fed. Cir. 2004) (“[I]t is improper to read limitations from a preferred embodiment described in the specification—even if it is the only embodiment—into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.”).

Decision Granting Institution at 31-32 (Paper 7).

“Incremental Value” is Presumed to have Meaning



“While not an absolute rule, all claim terms are presumed to have meaning in a claim.”

Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc., 381 F.3d 1111, 1119 (Fed. Cir. 2004).



**Patrick Mercier,
Ph.D.**

I understand that all claim terms are presumed to have meaning. Thus, the use of the term “incremental” in relation to the adjusted transmission frequency is presumed to mean more than simply increasing or decreasing (reducing) the transmission frequency.

EX2009 at ¶ 118; *see also* POR at 31 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Incremental Value"

A series of feedback signals is sent to the driver, resulting in a series of incremental increases/decreases in transmission frequency.

POR at 32 (Paper 12); EX2009 at ¶ 121.

One example of a power regulation method using simple feedback signals is shown in the flowchart of FIG. 6d. The method involves the following steps: (a) The driver 6230 provides an oscillating voltage at a transmission frequency f_t which is higher than the resonant frequency f_R of the system; (b) A secondary voltage is induced in the secondary coil 6320; (c) A power monitor in the secondary unit 6300, monitors the power received by the electric load 6340; (d) If the power received by the electric load 6340 lies within a predetermined range then no action is taken. If the power received by the electric load E340 is below the predetermined range, then a feedback signal of a first type S_a is sent to the driver. If the power received by the electric load 6340 is above the predetermined range, then a feedback signal of a second type S_b is sent to the driver; (e) A feedback signal is received by the driver 6230; (f) If the received feedback signal is of the first type S_a , then the transmission frequency is increased by an incremental value $+\delta f_1$. If the received feedback signal is of the second type S_b , then the transmission frequency is decreased by an incremental value $-\delta f_2$.

It is noted that by using the power regulation method described above, when the power received by the load is too high, a series of feedback signals of the first type S_a will be transmitted until the power is reduced into the acceptable range. Likewise when the power received by the load is too low, a series of feedback signals of the second type S_b will be transmitted until the power is increased into the acceptable range. It is noted that the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 .

EX1001 at 22:45-23:7; see also POR at 31 (Paper 12)

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

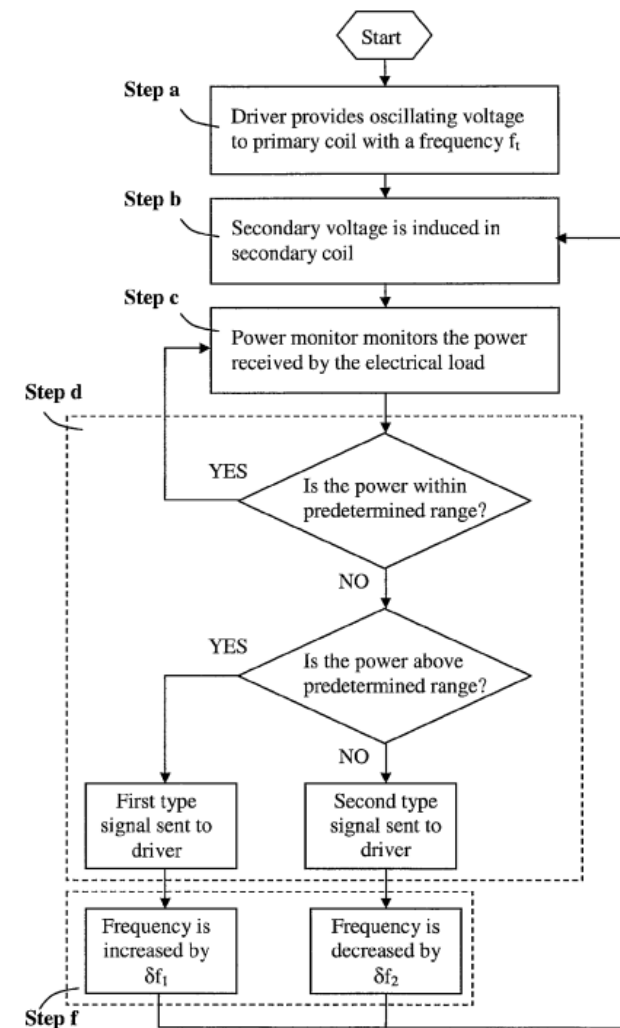


Fig. 6d

EX1001 at Fig. 6d; see also POR at 31 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Incremental Value"

One example of a power regulation method using simple feedback signals is shown in the flowchart of FIG. 6d. The method involves the following steps: (a) The driver 6230 provides an oscillating voltage at a transmission frequency f_t which is higher than the resonant frequency f_R of the system; (b) A secondary voltage is induced in the secondary coil 6320; (c) A power monitor in the secondary unit 6300, monitors the power received by the electric load 6340; (d) If the power received by the electric load 6340 lies within a predetermined range then no action is taken. If the power received by the electric load E340 is below the predetermined range, then a feedback signal of a first type S_a is sent to the driver. If the power received by the electric load 6340 is above the predetermined range, then a feedback signal of a second type S_b is sent to the driver; (e) A feedback signal is received by the driver 6230; (f) If the received feedback signal is of the first type S_a , then the transmission frequency is increased by an incremental value $+\delta f_1$. If the received feedback signal is of the second type S_b , then the transmission frequency is decreased by an incremental value $-\delta f_2$.

It is noted that by using the power regulation method described above, when the power received by the load is too high, a series of feedback signals of the first type S_a will be transmitted until the power is reduced into the acceptable range. Likewise when the power received by the load is too low, a series of feedback signals of the second type S_b will be transmitted until the power is increased into the acceptable range. It is noted that the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 .

EX1001 at 22:45-23:7; see also POR at 31 (Paper 12)



Gary L. Woods,
Ph.D.

Q. Do you agree that [22:45-23:7] provides context for how the term "incremental" is used in the '204 patent?

A. Yes. A POSITA would – yes, a POSITA would get an idea of what "increment" means based on this paragraph. Taken in the context of the entire patent.

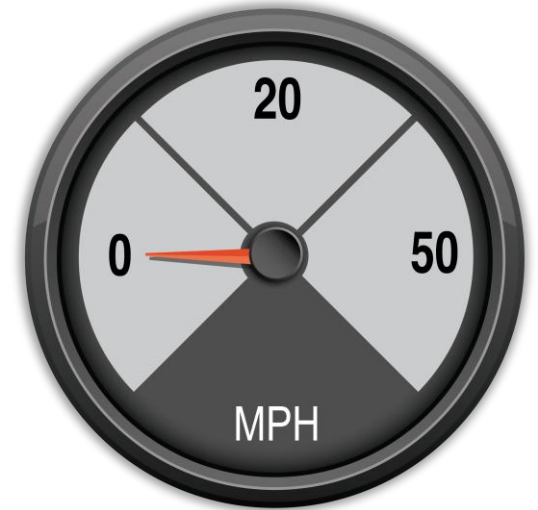
EX2013 at 42:24-43:5; see also PO Sur-Reply at 7 (Paper 20)

Incremental Adjustment vs. Selection of Discrete Values



**Patrick Mercier,
Ph.D.**

- A. So let's say you're driving a car. You're on the freeway. There's lots of traffic, and your car can only select from one of a small number of discrete speeds. It can go 0 miles per hour, it can go 20 miles per hour, or it can go 50 miles per hour. You're going to have a hard time driving that car on the freeway and not crashing into people. That is an example, I would say, of a – of a feedback system. You, being the driver, is feeding back with respect to visual information on the highway and steering and adjusting the speed so that you can drive safely and not crash. In contrast, a car that has the ability to incrementally adjust its speed by, say, integer multiples of miles per hour – so can you go 0, 1, 2, 3, 4, all the way up to, say, 65 miles per hour – those smaller incremental adjustments allows the driver, in feedback with what's going on on the freeway, to adjust their speed to be driving in a safe and stable manner.



EX1103, 63:3-63:22; *see also* PO Sur-Reply at 7-8 (Paper 12).

Intrinsic Evidence Supports Patent Owner's Construction of "Incremental Value"



**Patrick Mercier,
Ph.D.**

124. Indeed, the feedback loop of Figure 6d would make little sense if the system relied on the selection of a small handful of discrete frequencies. To the contrary, this embodiment relies on incremental increases or decreases (e.g., $+\delta f_1$ or $-\delta f_2$) to gradually adjust the transmission frequency to an “acceptable range.” See Ex. 2013 at 48:19-49:3 (“Q. How would a person of skill determine the acceptable range? A. In the context of this patent, . . . [t]he acceptable range of power received by the load would be sufficient for the load to perform its function but not so high as to cause unwanted effects. For instance, overheating.”).

125. Moreover, the '204 Patent explains that “the positive incremental value δf_1 may be greater than, less than or equal to the negative incremental value δf_2 .” '204 Patent at 23:5-7. Thus, a POSITA would recognize that the series of incremental adjustments are more than fixed discrete frequency values that have a significant delta between them.

EX2009 at ¶¶ 124-125; see also POR at 33 (Paper 12).

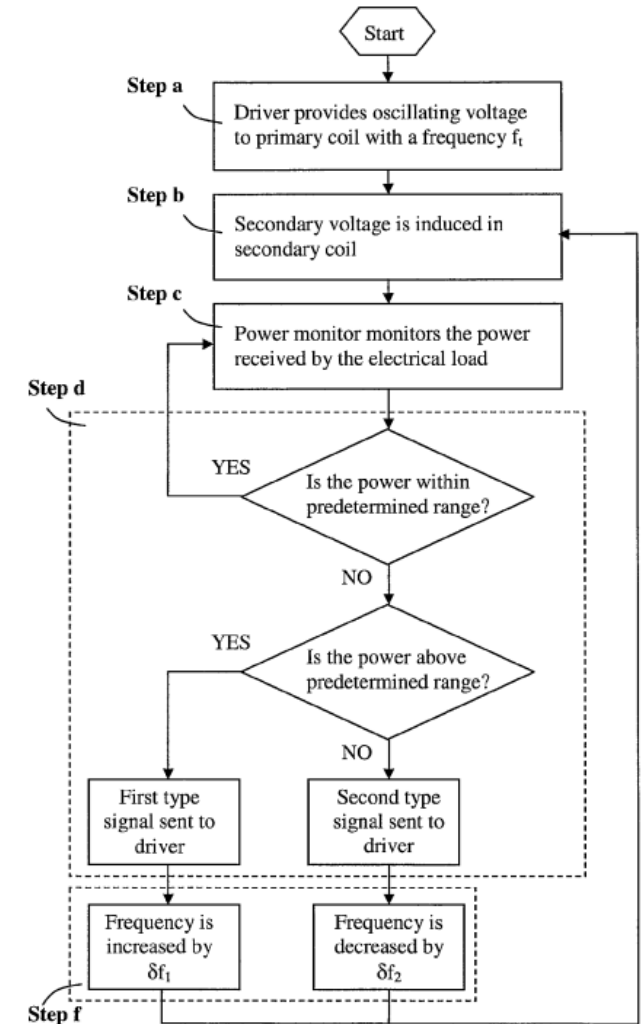
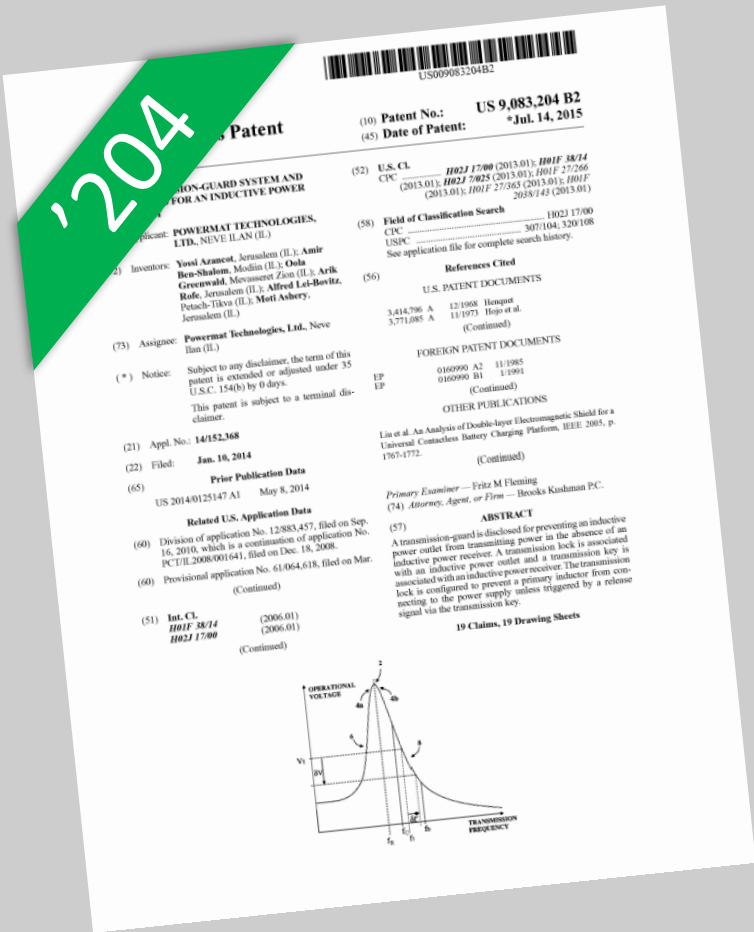


Fig. 6d

EX1001 at Fig. 6d; see also POR at 31 (Paper 12).



TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY

U.S. PATENT NO. 9,083,204

DEFICIENCIES OF GROUNDS 1A AND 1B

Claim 1

[1.2] said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,

Onishi Fails to Disclose Limitation [1.2]

[0180] FIG. 4 is a view showing the resonance characteristics of the induction coil and applications of frequencies. The resonance characteristics of the primary coil L1 and the secondary coil L2 when the portable telephone 510 is placed on the charger 500 (cradle) (i.e., when load exists with respect to the power transmission device 10) (see FIG. 1A) have a symmetrical and broad mountain shape, as shown in FIG. 4, for example. In FIG. 4, the horizontal axis indicates the frequency, and the vertical axis indicates the resonance peak value.

EX1004 at [0180]; *see also* POR at 37 (Paper 12).

136. Although Onishi states that “[t]he resonance characteristics of the primary coil L1 and the secondary coil L2 . . . have a symmetrical and broad mountain shape, as shown in FIG. 4” (Onishi at [0180]), a POSITA would understand that this discussion relates to two independent inductive coils as opposed to an inductive couple formed therebetween. As noted above, the preceding sentence clearly establishes that Figure 4 pertains to the resonance characteristics of the induction coil—not a pair of inductively coupled coils. Grounded in this context, a POSITA would recognize this sentence as referring to the resonance characteristics of independent coils (i.e., the primary or secondary coil).

EX2009 at ¶ 136; *see also* POR at 41 (Paper 12).

Claim 1

[1.2] said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,

Onishi Fails to Disclose Limitation [1.2]

[0135] The power transmission section 12 may include a first power transmission driver which drives one end of the primary coil L1, a second power transmission driver which drives the other end of the primary coil L1, and at least one capacitor which forms a resonant circuit together with the primary coil L1.

EX1004 at [0135]; POR at 37 (Paper 12).

Claim 1

[1.2] said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,

Onishi Fails to Disclose Limitation [1.2]



**Gary L. Woods,
Ph.D.**

- Q.** Now, will an inductive couple of primary coil L1 and capacitor C1 and C2 and secondary coil L2 with capacitor CB1 have a characteristic resonant frequency that is different than the characteristic resonant frequent of the primary coil L1 along with capacitor C1 and C2?
- A.** You're asking if the coupled system has a different resonance frequency than the transmission section alone with no receiver?
- Q.** Correct.
- A.** Yes.

EX2010 at 8:22-9:9; *see also* POR at 38-39 (Paper 12).

Claim 1

[1.2] said primary inductive coil for forming an inductive couple having a characteristic resonant frequency with at least one secondary inductive coil wired to an electric load,

Onishi Fails to Disclose Limitation [1.2]



**Gary L. Woods,
Ph.D.**

- Q.** Do you agree that the characteristic resonance frequency of the inductive couple system is dependent on both the characteristic resonant frequency of the primary coil L1 resonant frequency and the secondary resonant frequency of coil L2?
- A.** Yes. Among other things.

EX2010 at 10:7-14; *see also* POR at 39 (Paper 12).

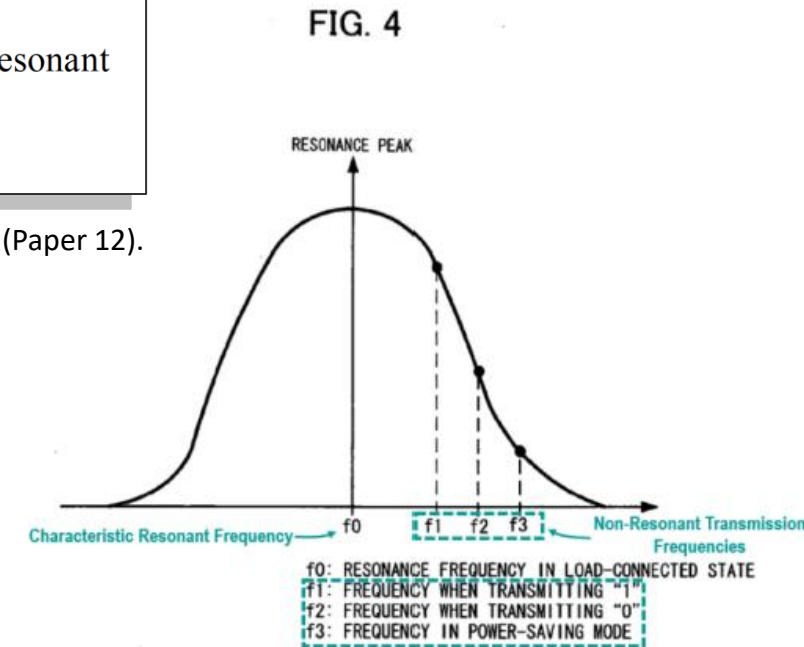
Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper

Petitioner asserts that Onishi discloses “a non-resonant transmission frequency (e.g., frequencies f_1 , f_2 , or f_3) substantially different from said characteristic resonant frequency (e.g., frequency f_0) of said inductive couple.” Pet., 23. In support of this assertion, Petitioner argues that “each of frequencies f_1 , f_2 , and f_3 lie in a near-linear region of the frequency-response curve and thus . . . fall within the scope of being ‘substantially different’ from the characteristic resonant frequency f_0 .” Pet., 24-25.

POR at 44 (Paper 12).



Pet. at 24 (Paper 2) (annotated by Petitioner).

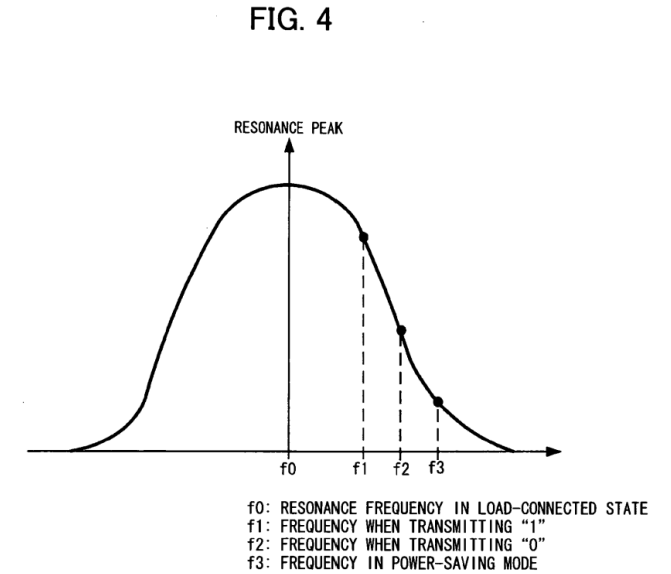
Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper

[0181] In FIG. 4, the frequency f_1 is a frequency used when transmitting "1" during normal power transmission. The frequency f_1 is a basic frequency during power transmission. The frequency f_2 is a frequency used when transmitting "0" (see FIGS. 3A and 3B). A frequency f_3 is a frequency used in the power-saving mode. As is clear from FIG. 4, the relationship " $f_1 > f_2 > f_3$ " is satisfied.

EX1004 at [0181]; see also POR at 44-49 (Paper 12).



EX1004 at FIG. 4; see also POR at 46 (Paper 12).

- Figure 4 is not drawn to scale.
- Figure 4 lacks axis labels.
- The x-axis in Figure 4 cannot be frequency if "the relationship ' $f_1 > f_2 > f_3$ ' is satisfied."

POR at 44-49 (Paper 12); PO Sur-Reply at 16-17 (Paper 20); EX2009 at ¶¶ 143-150.

Claim 1

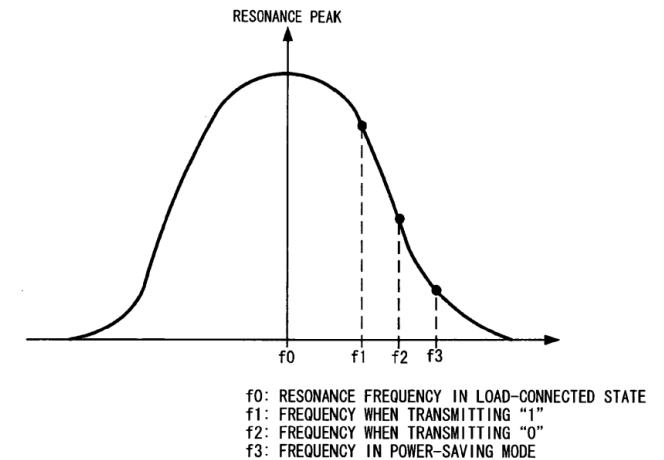
[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper

147. While Figure 4 of Onishi and Figure 6b of the '204 Patent both depict parabolic like curves, without dimensions or vertical-axis labels a POSITA would not be able to draw any conclusions regarding any similarities between the two illustrations. For example, if we assume *arguendo* that the vertical axis label in Figure 4 of Onishi is "RESONANCE PEAK," this does not make sense: this is not a variable that varies with frequency, rather it is a single frequency that is achieved at "peak" impedance, voltage, current or some other electrical characteristic—it is not a variable to be used in this context as a vertical axis of a plot versus frequency. Onishi at Fig. 4.

EX2009 at ¶ 147; *see also* POR at 47-48 (Paper 12).

FIG. 4



EX1004 at FIG. 4; *see also* POR at 36 (Paper 11).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper



**Gary L. Woods,
Ph.D.**

- Q.** And does figure – does figure 4 identify power transfer?
- A.** The vertical axis is – we don't exactly know what the vertical axis is. A POSITA would take that to mean either power transferred or possibly current delivered to the load, or possibly voltage across the primary coil.

EX2013 at 58:25-59:5; *see also* POR at 48 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper



**Gary L. Woods,
Ph.D.**

- Q.** Is the resonance peak of a system a single frequency achieved at peak impedance, voltage, current or some other electrical characteristic, or is it a variable that can vary with frequency?
- A.** I would say in a precise sense, a resonance frequency is what he said, it corresponds to a single point on a graph. But clearly, I mean, **Onishi is kind of playing fast and loose here**. He labeled the peak “resonance peak,” but – he labeled – the term “resonance peak” appears right above the Y axis. Which I think a POSITA would take to mean that that represents a title for the entire graph, which is the solid line as shown in the figure which exhibits a resonance peak at F0.

EX2013 at 64:22-65:14 (emphasis added); *see also* POR at 48-49 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper



**Gary L. Woods,
Ph.D.**

- Q.** [B]ased on the disclosure in paragraph 181 of Onishi, do you agree that it's possible for the Y axis of figure 4 to represent frequency based on the relationship F1 being greater than F2 being greater than F3? . . .
- A.** [Y]es, the Y values along the curve at frequencies F1 and F2 and F3 do satisfy the relationship specified by Onishi in paragraph [181].

EX1102 at 51:17-20;
see also PO Sur-Reply at 17 (Paper 20).

Notably, Petitioner fails to provide any arguments in response to this clear deficiency in Onishi (*see* PR, 19-25), and Dr. Woods acknowledged that “a POSITA would understand that the way Onishi has draw F1 and F2 and F3, the actual values of those frequencies **do not** satisfy the inequality in paragraph 181.” EX2013, 59:14-17 (emphasis added).

PO Sur-Reply at 17 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper



**Patrick Mercier,
Ph.D.**

Q. Are you familiar with Figure 4 in Onishi?

A. I am.

Q. Did you offer opinions regarding Figure 4 of Onishi in your declaration?

A. I did.

Q. And Figure 4 depicts a frequency response curve, correct?

A. Well, it depicts – it depicts a very confusing curve, I'll say, due to the lack of labels on the respective axes.

Mercier Dep. Tr. (EX1102) at 49:24-50:8; *see also* POR at 44-49 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Petitioner's Reliance on Onishi Figure 4 is Improper

Nothing in paragraph [0053] or elsewhere in Onishi implies that f_1 and f_2 “are not at or near the resonance frequency” as alleged. Frequencies f_1 and f_2 are merely positioned closer to resonance than f_3 , much like f_U is relatively closer to resonance than f_b in FIG. 6b of the '204 Patent.

PR at 21 (Paper 17) (emphasis added).

If Onishi only discloses the relative positions of frequencies f_1 , f_2 , and f_3 , then Onishi does not affirmatively disclose frequencies that lie within a specific region of a frequency-amplitude graph.

PO Sur-Reply at 15 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

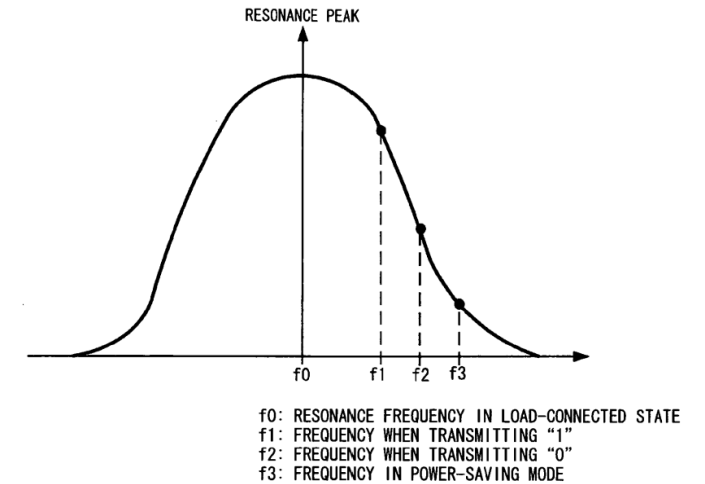
Onishi Fails to Disclose Limitation [1.5]

[0053] Power transmission (i.e., power-saving power transmission) that transmits a small amount of power as compared with normal power transmission is continuously performed after the battery has been fully charged so that power (power supply voltage) is supplied to the load. This ensures that the load maintains its charge management function even after the battery has been fully charged. Accordingly, when it is necessary to recharge the battery due to a discharge after the battery has been fully charged, the charge management function of the load causes the battery to be recharged automatically. Therefore, the battery can be easily recharged. Note that power-saving power transmission transmits only a small amount of power which merely maintains the battery charge management function of the load. Specifically, power consumption is sufficiently reduced during power-saving power transmission. The transmission frequency during power-saving power transmission is set at a frequency apart from the resonance frequency (resonance peak) as compared with the frequency during normal power transmission, for example. The power to be transmitted can also be reduced, even if the transmission frequency is the same, by increasing the frequency difference between the resonance frequency (resonance peak) and the transmission frequency by changing the resonance characteristics of the resonant circuit to change the resonance frequency (resonance peak).

EX1004 at [0053]; see also POR at 50 (Paper 12).

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

FIG. 4



EX1004 at FIG. 4; see also POR at 46 (Paper 12).

If frequency f3 is “apart” from the resonance frequency, then frequencies f1 and f2—as normal power transmission frequencies—are not apart from the resonance.

EX2009 at ¶ 144; see also POR at 49-50 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Onishi Fails to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

- Q.** What does the word “apart” mean to you in the context of paragraph 53 of Onishi?
- A.** I guess you would say – I guess Onishi would say distinguishable from. I think that’s a fair word a POSITA might have used at the time.
- Q.** What’s an antonym for “distinguishable from”?
- A.** Indistinguishable from.

EX2010 at 17:14-23; *see also* POR at 50 (Paper 12).

Claim 1

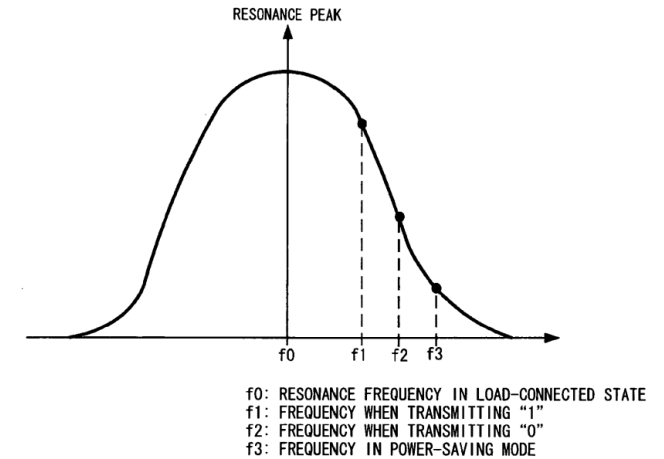
[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Onishi Fails to Disclose Limitation [1.5]

154. Onishi's power-saving mode frequency f_3 —while “set at a frequency apart from the resonance frequency” (Onishi at [0053])—is neither described, shown, nor otherwise disclosed as a transmission frequency that is substantially different from the characteristic resonance of the inductive couple.

EX2009 at ¶ 154; *see also* POR at 51 (Paper 12).

FIG. 4



EX1004 at FIG. 4; *see also* POR at 46 (Paper 12).

- Frequency f_3 is only described as being “apart” from frequency f_0 .
- Nothing establishes that frequency f_3 falls within the near-linear region of Figure 4.

POR at 51-55 (Paper 12); EX2009 at ¶¶ 154-159.

Claim 1

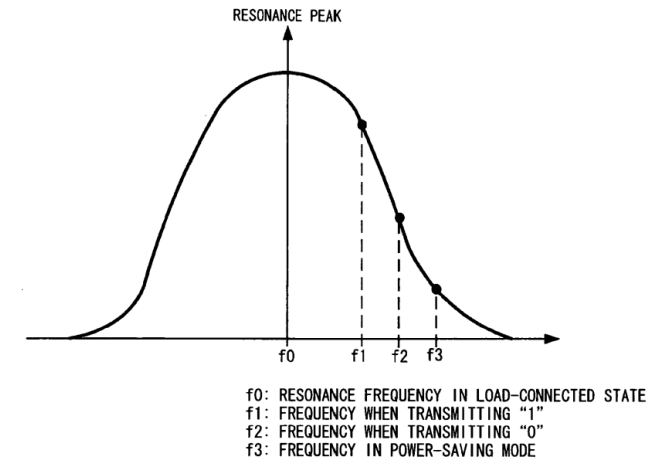
[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Onishi Fails to Disclose Limitation [1.5]

[0178] In the invention, a small amount of power is continuously transmitted in the power-saving mode after the battery has been fully charged based on the above consideration. Therefore, whether or not recharging is necessary can be determined and recharging can be started after the battery has been fully charged without adding a special configuration.

EX1004 at [0178]; *see also* POR at 54 (Paper 12).

FIG. 4



EX1004 at FIG. 4; *see also* POR at 46 (Paper 12).

Power-saving mode frequency f_3 corresponds to the region in which little to no power is transmitted to the receiver.

EX2009 at ¶ 158; *see also* POR at 54 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Onishi Fails to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

- Q.** Does Onishi provide any quantitative measure of the value of frequency F1?
- A.** Quantitative measure. I mean, there's not a formula – I mean, yeah, there's no number associated with it.
- Q.** Does Onishi provide any quantitative measure of the value of F1 relative to F0 for resonance frequency?
- A.** The closest we get to quantitate is about the same as in the ['204] patent where we have what looks to be a figure where you have some frequencies that are – they look to be different from the peak. In both those documents that's what we get.
- Q.** Okay, so the answer is no, Onishi doesn't provide any quantitative measure of the value of F1 relative to F0?
- A.** I would say Onishi is just as quantitative or not as ['204].
- Q.** Similarly, Onishi – does Onishi provide any quantitative measure of the value of F2?
- A.** Same answer.
- Q.** What about any quantitative measure of the value of F3?
- A.** Same answer.
- Q.** And similarly, Onishi doesn't provide any quantitative measure of the value of F3 relative to the resonant frequency?
- A.** Well, I guess Onishi defines it in several places where there's – he defines it –well, we know that at F3 it's in power-saving mode. And in paragraph, was it – right, in paragraph 178 it says a small amount of power is transmitted.

Woods Dep. Tr. (EX2010) at 22:17-24:4; *see also* POR at 46 (Paper 12).

Claim 1

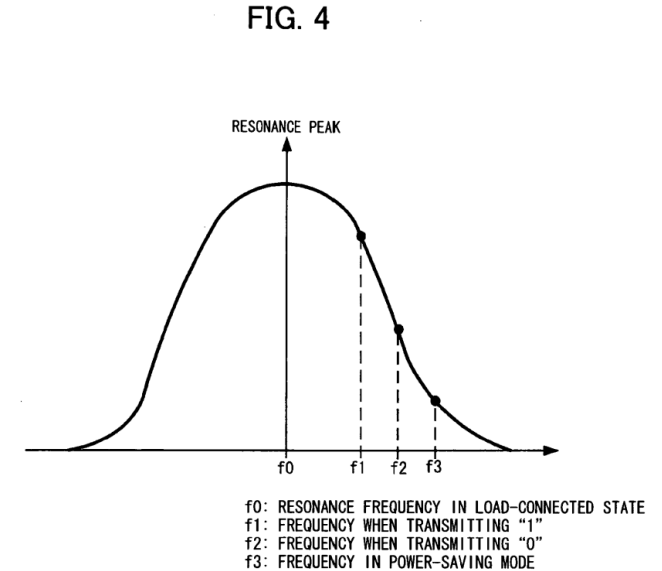
[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Onishi Fails to Disclose Limitations [1.7] and [1.8]

[0181] In FIG. 4, the frequency f_1 is a frequency used when transmitting “1” during normal power transmission. The frequency f_1 is a basic frequency during power transmission. The frequency f_2 is a frequency used when transmitting “0” (see FIGS. 3A and 3B). A frequency f_3 is a frequency used in the power-saving mode. As is clear from FIG. 4, the relationship “ $f_1 > f_2 > f_3$ ” is satisfied.

EX1004 at [0181]; see also POR at 55-57 (Paper 12).



EX1004 at FIG. 4; ; see also POR at 46 (Paper 12).

- Frequencies f_1 , f_2 , and f_3 are each discrete frequencies having a distinct purpose
- Any change in frequency (f_1 to f_2 , f_2 to f_3 , or f_1 to f_3) requires a non-linear decrease in the vertical axis value
- Any change in frequency (f_3 to f_2 , f_2 to f_1 , or f_3 to f_1) requires a non-linear increase in the vertical axis value

POR at 55-57 (Paper 12); EX2009 at ¶ 163.

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Onishi Fails to Disclose Limitations [1.7] and [1.8]



**Gary L. Woods,
Ph.D.**

Q. Does figure 4 disclose any other frequencies than F0, F1, F2 and F3?

A. Figure 4 just lists those four frequencies.

Woods Dep. Tr. (EX2010) at 24:23-24, 25:1-2; *see also* POR at 57-58 (Paper 12).

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

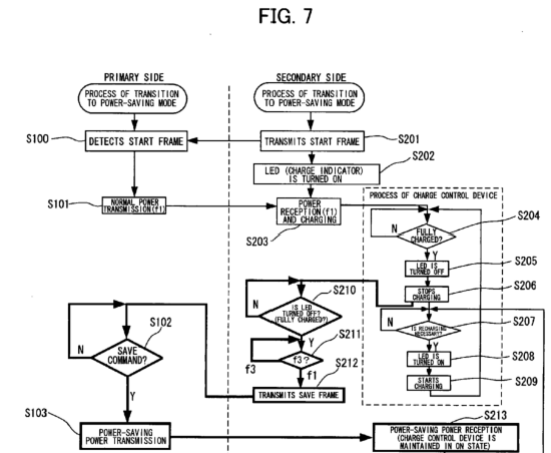


**Patrick Mercier,
Ph.D.**

Onishi Fails to Disclose Limitations [1.7] and [1.8]

166. Yet, even if frequency f_2 were interpreted as an incremental change between frequencies f_1 and f_3 , Onishi discloses—as illustrated below in Figure 7—that power transmission can switch from frequency f_1 to frequency f_3 without stepping through frequency f_2 . See, e.g., Onishi at [0226] (“The secondary-side instrument performs normal power reception (frequency f_1), and supplies power to the load 90 to effect recharging When the battery has been again fully charged . . . , the secondary-side instrument checks that the power transmission frequency is not the power-saving transmission frequency (f_3) . . . , and transmits the save frame (including save command) to the primary-side instrument This causes power-saving power transmission to again start”). Thus, Onishi does not disclose implicitly or explicitly increasing/decreasing the non-resonant transmission frequency by an incremental value.

EX2009 at ¶ 166; see also POR at 59 (Paper 12).



EX1004 at FIG. 7; see also POR at 60 (Paper 12).

Claim 1

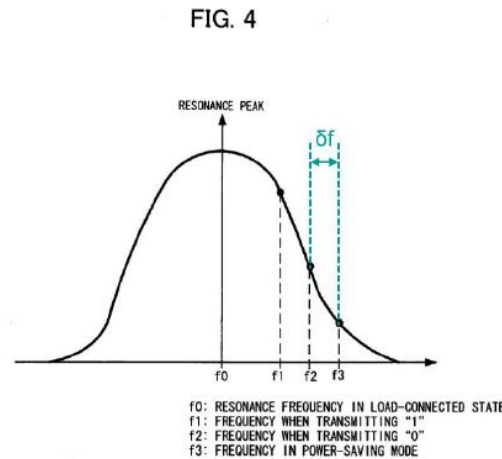
[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

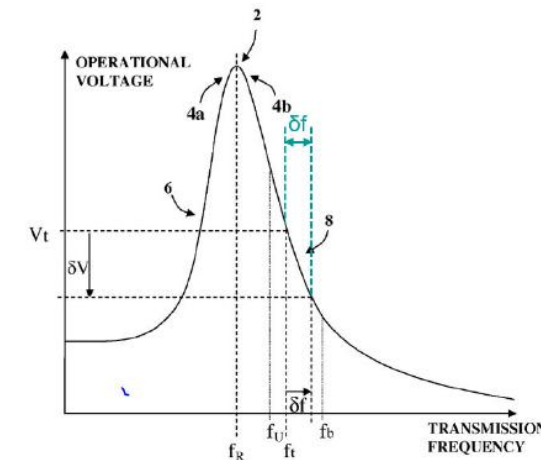
Onishi Fails to Disclose Limitations [1.7] and [1.8]

In fact, the delta between Onishi's frequencies f_2 and f_3 (and between f_1 and f_2) is shown to be of a similar scale to the incremental increase δf depicted in FIG. 6b of the '204 Patent (e.g., as a portion of the near-linear region of the frequency-amplitude graph):

PR at 26-27 (Paper 17).



Onishi, FIG. 4 (annotated)



'204 Patent, FIG. 6b (annotated)

PR at 26-27 (Paper 17).

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Onishi Fails to Disclose Limitations [1.7] and [1.8]



**Patrick Mercier,
Ph.D.**

- A.** I'll have to say, my understanding as a POSITA, Figure 6b is that delta F is a – is an exaggerated incremental frequency drawn for clarity in Figure 6b. I wouldn't anticipate an incremental advance, which appears to occupy approximately half of the frequency range, to represent an incremental frequency change. My guess is that the authors just drew it that way for clarity, and we often do this in engineering for non-to-scale drawings just to make sure people understand what we're doing and so that there is enough room to write "delta F," you know, in this case, but between those two dashed lines. . . .

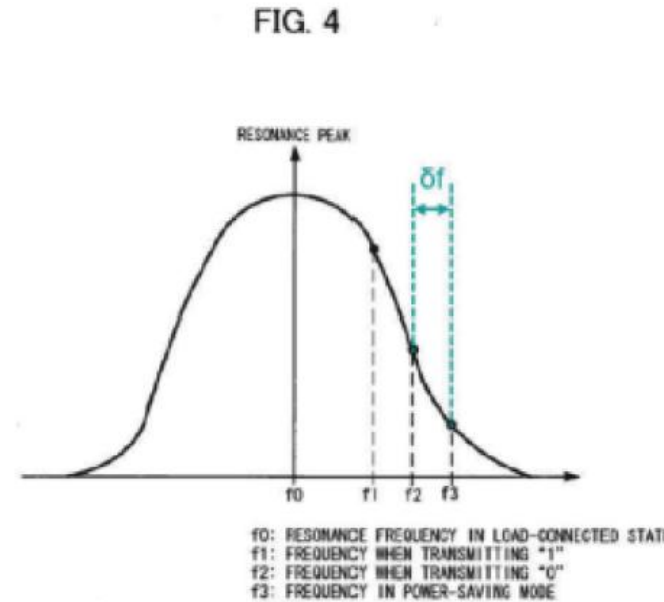
Mercier Dep. Tr. (EX1103) at 72:5-17; see PO Sur-Reply at 22-23 (Paper 20).

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Onishi Fails to Disclose Limitations [1.7] and [1.8]



Onishi, FIG. 4 (annotated)

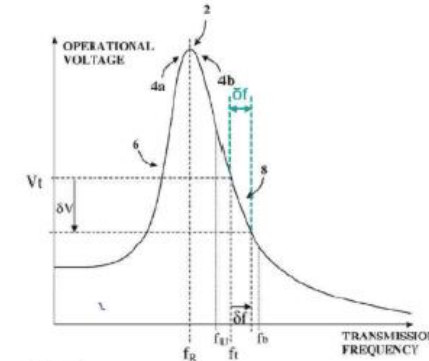
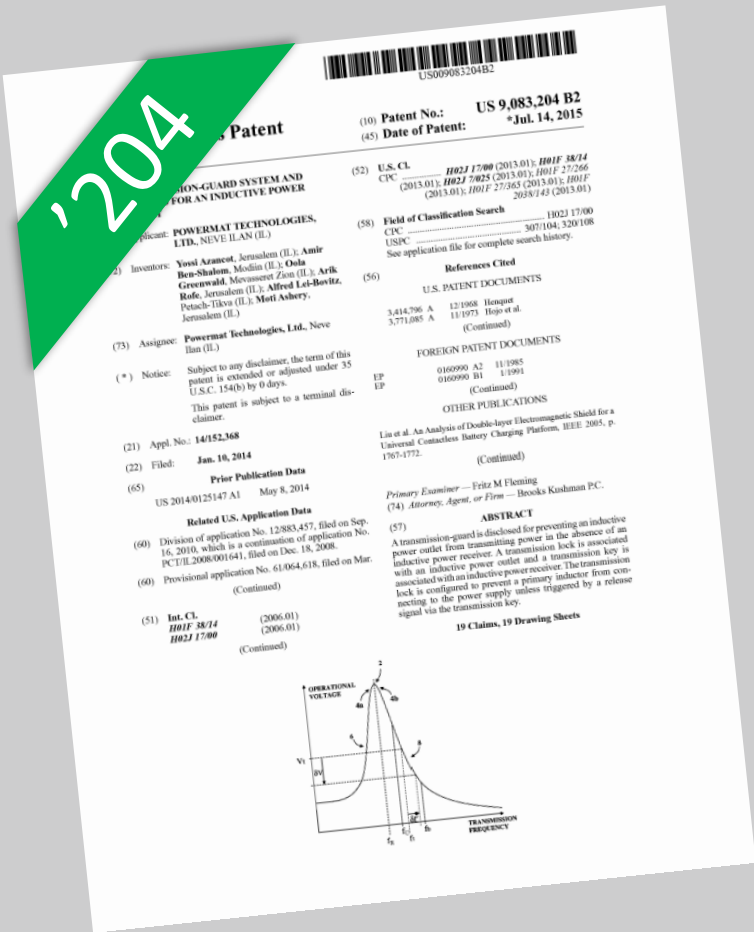


Fig. 6b

'204 Patent, FIG. 6b (annotated)

PO Sur-Reply at 23 (reproducing images resized to more accurately align x-axis and peak of parabolic curves)

- Aligning the x-axis and the peak of the parabolic curves illustrates that δf s are not of a similar scale.
- Petitioner improperly assumes that Figure 4 in Onishi and Figure 6b in the '204 Patent are drawn to scale.



TRANSMISSION-GUARD SYSTEM AND METHOD FOR AN INDUCTIVE POWER SUPPLY

U.S. PATENT NO. 9,083,204

DEFICIENCIES OF GROUND 2

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]

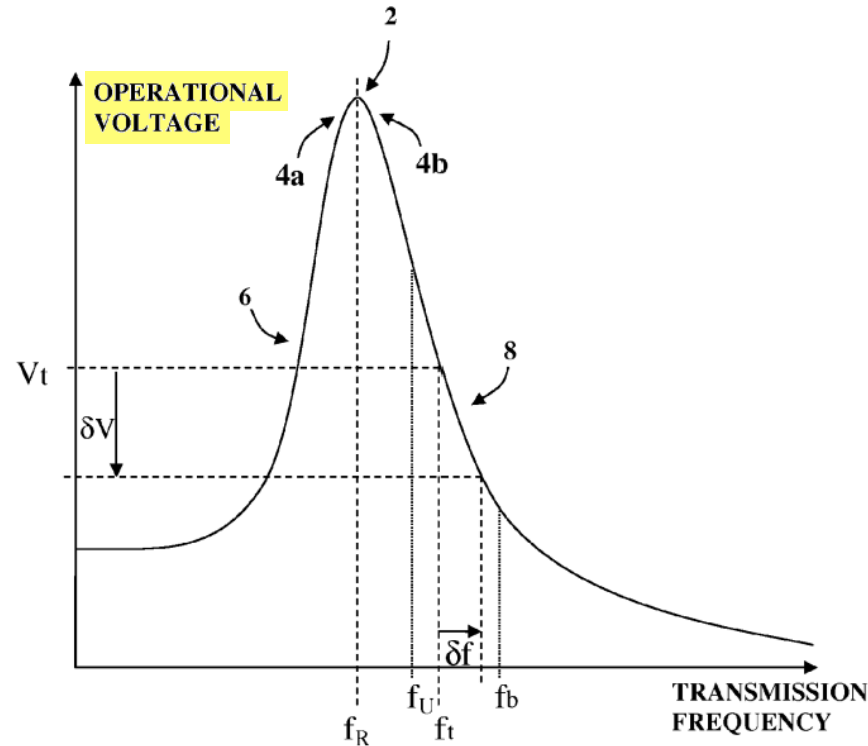


Fig. 6b

EX1001 at Fig. 6b; *see also* PO Sur-Reply at 25 (Paper 12).

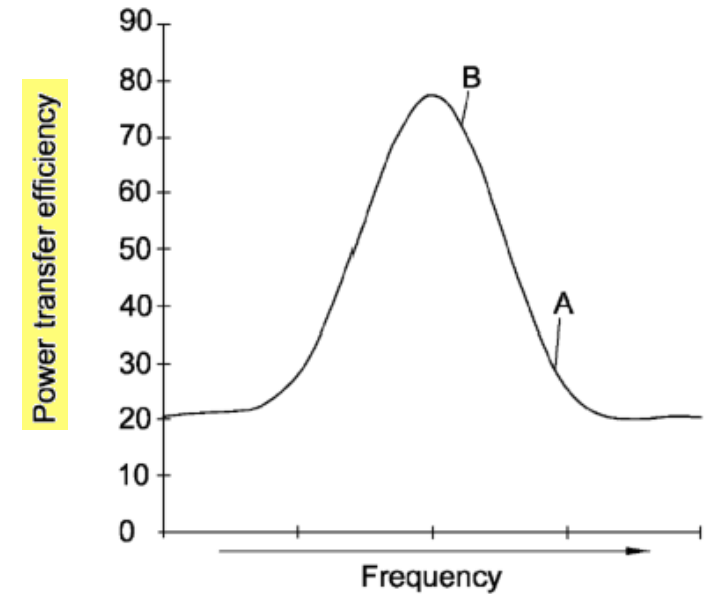


FIG. 3

EX1006 at FIG. 3; *see also* PO Sur-Reply at 25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Patrick Mercier,
Ph.D.**

- Q.** And what information do you glean from the labels on the axes on the Y-axis and the X-axis?
- A.** That the Y-axis is operational voltage and the X-axis is transmission frequency. . . .
- Q.** And what is operational voltage?
- A.** Operational voltage is the – my understanding is the output voltage of the inductive couple.
- Q.** And how does operational voltage relate to power transfer efficiency?
- A.** So these are two different things. Obviously voltage is a measure of voltage, and efficiency is typically a measure of the ratio of power numbers. While there are formulas that can convert voltage to power and subsequently to efficiency, this depends a lot on the relative impedances seen by both sides at the primary and secondary coils and so on. And so a plot of operational voltage versus transmission frequency might look quite a bit different than a plot of power transfer efficiency versus transmission frequency, for example, even on the exact same system. It really depends on a lot of other parameters.

Mercier Dep. Tr. (EX1103) at 79:10-11, 13-14, 22-24, 81:1-2, 5-18 (objections omitted); see PO Sur-Reply at 24-25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Patrick Mercier,
Ph.D.**

- Q.** Can you describe what's shown in Figure 6b?
- A.** Certainly. So this is a plot of the operational voltage at the output of an inductive couple where frequency – “fR” is the resonant – the characteristic resonant frequency at the inductive couple. The X axis is the transmission frequency. Again, Y axis at the operational voltage. “fT” indicates the frequency that is selected for transmission across the inductive couple. And there's a few other frequency markers there indicating other things, as well as other regions.

Mercier Dep. Tr. (EX1102) at 17:19-18:5; *see also* PO Sur-Reply at 24 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Patrick Mercier,
Ph.D.**

- Q.** What is the operational voltage?
- A.** I'm not sure if the operational voltage is precisely defined in the '696 patent, but my knowledge as a POSITA would – would say that this is the output voltage of the inductive couple.
- Q.** Can you explain what you mean by “the output voltage of the inductive couple”?
- A.** Sure. So if you refer to say – let's say Figure 1c in the '696 patent. . . . We have element 220, which is the primary inductor that then couples to element 320, which is the secondary inductor. I'm referring to the output of the secondary inductor. And I should be more specific here in saying, you know, this is – the output of the secondary inductor is going to be a sinusoidal-like waveform in the time domain. And what Figure 6b is showing is the amplitude of what the voltage would be in the frequency domain.

Mercier Dep. Tr. (EX1102) at 19:2-22; see PO Sur-Reply at 24 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

- Q.** Okay, in figure 3 that we were just referencing in Baarman '392, what's represented by the Y axis in the figure?
- A.** He's showing it as power transfer efficiency.
- Q.** How is power transfer efficiency measured in figure 3? Or maybe a better question would be what unit is power transfer efficiency measured in?
- A.** I don't remember how Baarman defines power transfer efficiency. Would you like me to look it up?
- Q.** Sure. I would suggest, is it a percentage?
- A.** Probably – yeah, it's a percentage of something. I don't know if he's talking about end-to-end power transfer efficiency from wall plug to final battery or just transfer efficiency across the inductive couple. Right, I don't know how – I don't know what he's defining. But in general, efficiencies are thought of as percent.
- Q.** Do you recall whether Baarman '392 describes how – or what kind of transfer efficiency he's talking about?
- * * *
- A.** Okay, so yeah, in paragraph 27 of Baarman, on page 10, he says that figure 3 is a power transfer curve between a primary coil and secondary coil. So he's talking about just the efficiency of power transfer from the primary coil to the secondary coil. He's not including other effects like – other elements in the system. This is just coil-to-coil power transmission efficiency.

Woods Dep. Tr. (EX2010) at 37:4-38:4, 12-21; see PO Sur-Reply at 24-25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]

177. *First*, Baarman392 describes the general operation of its inverter as in the range between frequency A and frequency B, where frequency B “is somewhat less than the resonant frequency.” Ex. 1006, at [0038]. However, frequencies “somewhat less than the resonant frequency” are—by definition—not substantially different from the resonant frequency, as claimed.

EX2009 at 177; *see also* POR at 64 (Paper 12).

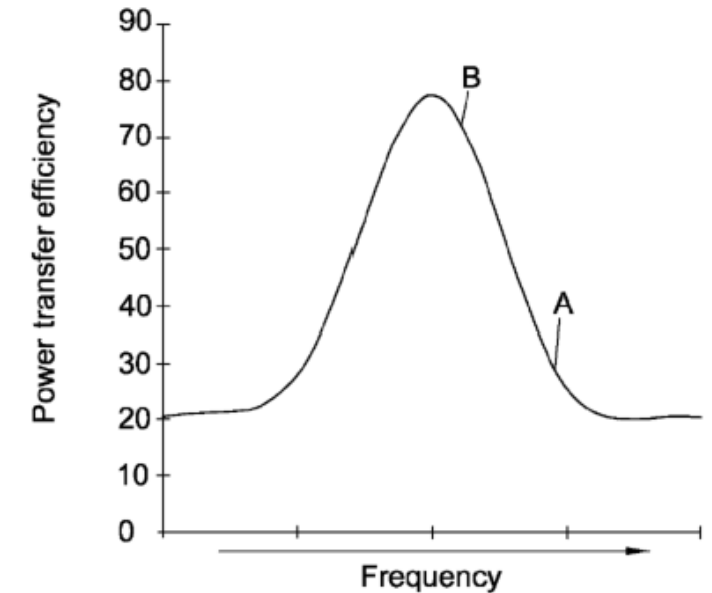


FIG. 3

EX1006 at FIG. 3;
see also PO Sur-Reply at 25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

- Q.** Is it your opinion that frequencies that are somewhat less than the resonant frequency are substantially different than the resonant frequency?
- A.** I don't know about in general, but I would say frequency B is – we know it's not on resonance. Baarman says so. So I would say that makes it substantially different.

Woods Dep. Tr. (EX2010) at 33:12-20; *see also* POR at 64 (Paper 12).

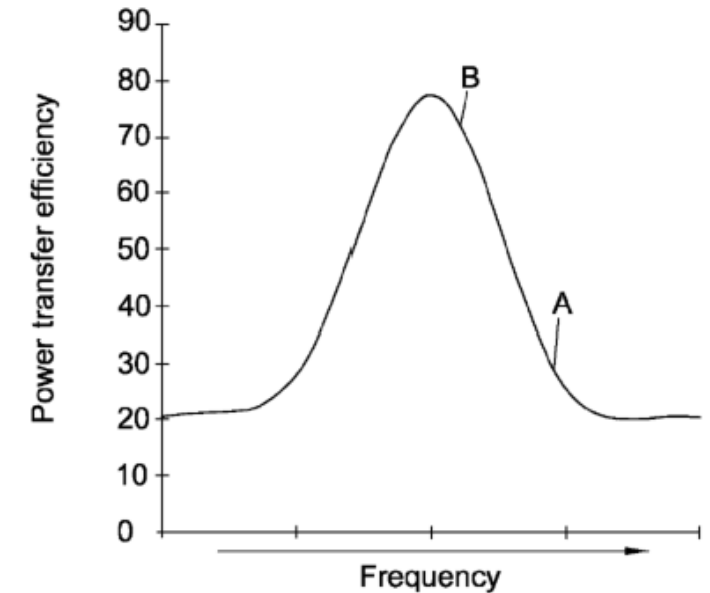


FIG. 3

EX1006 at FIG. 3;
see also PO Sur-Reply at 25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

- Q.** Does Baarman 392 quantify the operating frequency of frequency B?
- A.** Quantify. We know it's not on resonance.
- Q.** What about does Baarman '392 quantify the operating frequency of frequency A?
- A.** We know from the figure it's farther away from resonance than is frequency B.
- Q.** And other than it being farther away from frequency B, does Baarman '392 quantify the difference between those two operating frequencies B and A?
- A.** Quantify, he doesn't present an equation. This is – the figure 3 is describing the essential elements, but if you wanted the actual equation of that curve it would be complicated.

Woods Dep. Tr. (EX2010) at 32:18-33:11; *see also* PO Sur-Reply at 27 (Paper 20).

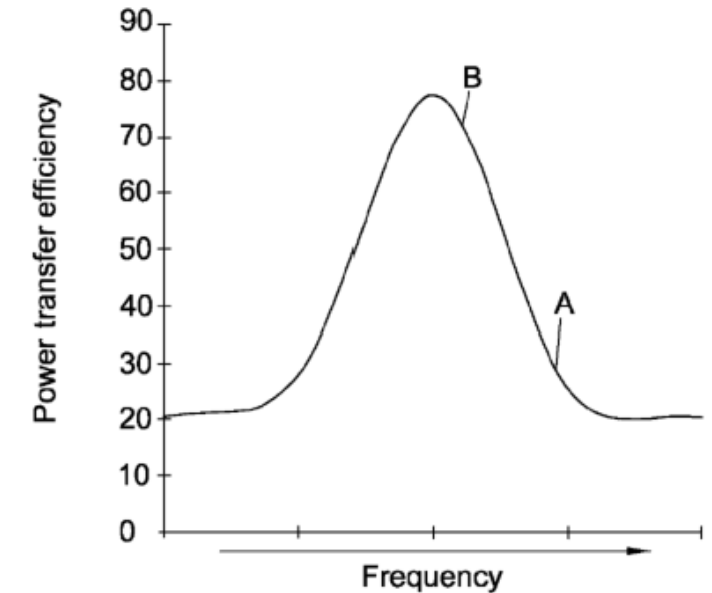


FIG. 3

EX1006 at FIG. 3;
see also PO Sur-Reply at 25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Patrick Mercier,
Ph.D.**

- Q.** What's your understanding of what A and B represent?
- A.** So Frequency B is, as described in Baarman, somewhat less than the resonant frequency, and Frequency A is some other frequency further away from that. I think that's pretty much all we can surmise from the language in Baarman.

Mercier Dep. Tr. (EX1102) at 79:18-24; *see also* PO Sur-Reply at 27 (Paper 20).

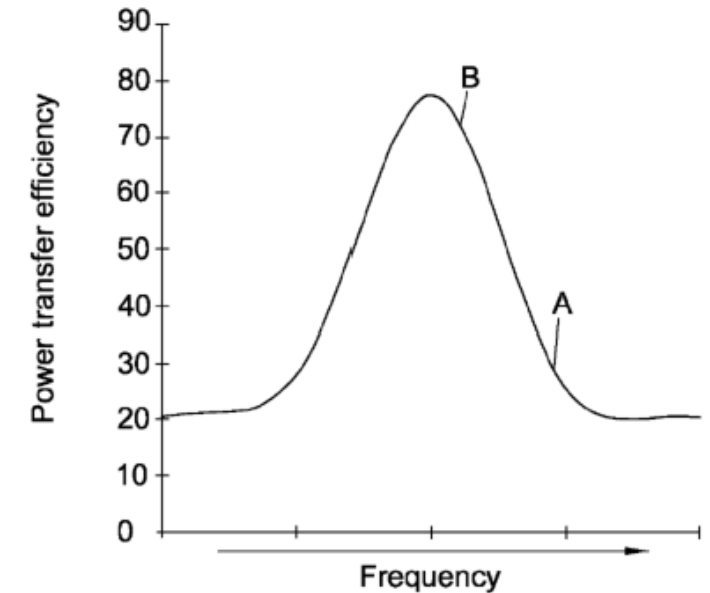


FIG. 3

EX1006 at FIG. 3;
see also PO Sur-Reply at 25 (Paper 20).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]

[0038] In the illustrated embodiment, the primary coil 15 and the secondary coil 30 are loosely coupled. Because the two are loosely coupled in this embodiment, the slope of the power transfer curve about the resonant frequency is not as steep as if the coils 15, 30 were tightly coupled. An exemplary power transfer curve for the coils 15, 30 is shown in FIG. 3. In this embodiment, the power transfer is highest when the inverter 10 is operating at resonance. However, even if the inverter 10 is not operating at resonance, significant power transfer can occur when the inverter is operating off-resonance. Generally, the inverter 10 is operated between frequency A and frequency B. Frequency B is somewhat less than the resonant frequency. Between frequency A and frequency B, the power transfer curve can be piece-wise linearized by a software lookup table located in the controller 20. Thus, a decrease in the operating frequency of the inverter 10 will result in a generally predictable increase in the power transferred from the primary coil 15 to the secondary coil 30. As can be seen by the graph, it would be equally effective to use an operating frequency less than the resonant frequency. If so, then an increase in the operating frequency would lead to an increase in the power transfer, and vice-versa.

EX1006 at [0038]; see also POR at 66-67 (Paper 12).

Claim 1

[1.5] said driving voltage oscillating at a non-resonant transmission frequency substantially different from said characteristic resonant frequency of said inductive couple,

Baarman392 + Tocci Fail to Disclose Limitation [1.5]



**Gary L. Woods,
Ph.D.**

Q. [W]hat is a piecewise linear function?

A. That basically means if you have a – right, if you have a curve, you can break it down into – you can approximate it more accurately by treating it as a series of two or more line segments.

Woods Dep. Tr. (EX2010) at 34:4-10; *see* POR at 66-67 (Paper 12).

Claim 1

[1.7] said driver is configured to: provide less power by increasing said non-resonant transmission frequency by an incremental value when said first signal is detected by the detector, and

Baarman392 + Tocci Fail to Disclose Limitation [1.7]

[0038] In the illustrated embodiment, the primary coil 15 and the secondary coil 30 are loosely coupled. Because the two are loosely coupled in this embodiment, the slope of the power transfer curve about the resonant frequency is not as steep as if the coils 15, 30 were tightly coupled. An exemplary power transfer curve for the coils 15, 30 is shown in FIG. 3. In this embodiment, the power transfer is highest when the inverter 10 is operating at resonance. However, even if the inverter 10 is not operating at resonance, significant power transfer can occur when the inverter is operating off-resonance. Generally, the inverter 10 is operated between frequency A and frequency B. Frequency B is somewhat less than the resonant frequency. Between frequency A and frequency B, the power transfer curve can be piece-wise linearized by a software lookup table located in the controller 20. Thus, a decrease in the operating frequency of the inverter 10 will result in a generally predictable increase in the power transferred from the primary coil 15 to the secondary coil 30. As can be seen by the graph, it would be equally effective to use an operating frequency less than the resonant frequency. If so, then an increase in the operating frequency would lead to an increase in the power transfer, and vice-versa.

EX1006, [0038]; see also POR at 69 (Paper 12).

[0056] $\Delta FREQ$ could be a constant, or it could be determined by obtaining the value from a lookup table indexed by the operating frequency of the inverter at the particular time $\Delta FREQ$ is used. The values selected for $\Delta FREQ$ may be frequency dependent and chosen so that if the operating frequency is reduced or increased by $\Delta FREQ$, then the corresponding increase or decrease in current is the approximately the same for $\Delta FREQ$ s for all operating frequencies. For example, if the charger circuit 6 is operating near the resonant frequency of the tank circuit 12, then a decrease in the operating frequency by 100 Hz will substantially increase the current through the tank circuit 12. If, on the other hand, the charger circuit 6 is operating relatively far from resonance, then a change of 100 Hz will not result in a substantial increase in the current through the primary. $\Delta FREQ$ may therefore be chosen to cause approximately the same change in primary current at a low frequency or a high frequency

EX1006, [0056]; see also PO Sur-Reply at 28029 (Paper 12).

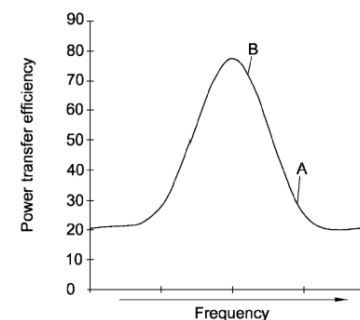


FIG. 3

EX1006 at FIG. 3;
see also POR at 69 (Paper 20).

Claim 1

[1.8] provide more power by decreasing said non-resonant transmission frequency by an incremental value when said second signal is detected by the detector.

Baarman392 + Tocci Fail to Disclose Limitation [1.8]



**Patrick Mercier,
Ph.D.**

[R]eception of a feedback signal causes Baarman392 to stop decreasing the frequency of the power signal applied to the primary coil, rather than “decreasing said non-resonant frequency by an incremental value when said second signal is detected by the detector” as in claim [1.8]. A POSITA would interpret the latter (detection of the second signal) as effectively triggering the decrease in frequency, which Baarman392 does not disclose.

EX2009 at ¶ 191; *see also* POR at 70-71 (Paper 12).

[0019] In one embodiment, the charging step generally includes the steps of incrementally moving the frequency of the power applied to the primary coil closer to resonance until a feedback signal is received; after a feedback signal is received, incrementally moving the frequency of the power applied to primary close farther from resonance until a feedback signal is no longer received; and applying power to the primary coil at the frequency for a charging period. The process may be repeated.

EX1006 at [0019]; *see also* POR at 70-71 (Paper 12).