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(54) **LOW POWER OBJECT DETECTION IN MULTI-COIL WIRELESS CHARGING SYSTEMS AND RELATED SYSTEMS, METHODS, AND DEVICES**

(71) Applicant: **Microchip Technology Incorporated**, Chandler, AZ (US)

(72) Inventors: **Santosh Bhandarkar**, Chandler, AZ (US); **Alex Dumais**, Boise, ID (US)

(73) Assignee: **Microchip Technology, Inc.**, Chandler, AZ (US)

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This patent is subject to a terminal disclaimer.

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H02J 50/60 (2016.01)
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CPC ***H02J 50/60*** (2016.02); ***G01R 27/2611*** (2013.01); ***H02J 50/12*** (2016.02); ***H02J 50/402*** (2020.01)

(58) **Field of Classification Search**
CPC .. H02J 5/005; H02J 7/025; H02J 50/12; H02J 50/402; H02J 50/60
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,130,395 B2 9/2015 Jung
2010/0219796 A1 9/2010 Kallmyer
(Continued)

FOREIGN PATENT DOCUMENTS

CN 108702179 A 10/2018
CN 110121665 A 8/2019
(Continued)

OTHER PUBLICATIONS

"The Qi Wireless Power Transfer System Power Class 0 Specification," Part 4: Reference Designs, Version 1.2.4, Qi Wireless Power Consortium, Feb. 2018, 363 pages.
(Continued)

Primary Examiner — Levi Gannon
(74) *Attorney, Agent, or Firm* — TraskBritt

(57) **ABSTRACT**

Object detection for wireless power transmitters and related systems, methods, and devices are disclosed. A controller for a wireless power transmitter is configured to receive a measurement voltage potential responsive to a tank circuit signal at a tank circuit, provide an alternating current (AC) signal to each of the plurality of transmit coils one at a time, and determine at least one of a resonant frequency and a quality factor (Q-factor) of the tank circuit responsive to each selected transmit coil of the plurality of transmit coils. The controller is also configured to select a transmit coil to use to transmit wireless power to a receive coil of a wireless power receiver responsive to the determined at least one of the resonant frequency and the Q-factor for each transmit coil of the plurality of transmit coils.

20 Claims, 10 Drawing Sheets