1. An apparatus, comprising:

- at least one processor; and
- at least one memory including computer program code,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to:

- initiate a wireless charging and send a charging notification to an end user;
- send a battery full message for notifying the end user when a battery is charged to a full voltage by the wireless charging and terminating the wireless charging;
- set the apparatus to a standby mode and monitor a ping signal from a wireless charger transmitter to detect whether the apparatus is removed from the wireless charger transmitter.
- enter a maintenance charging mode without sending the charging notification to the end user, when a voltage of the battery drops from the full voltage to below a recharging threshold; and
- continue the maintenance charging mode of the apparatus until the battery is charged to the full voltage or the apparatus is removed from the wireless charger transmitter.

https://patents.google.com/patent/US9509171
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   charging;
   set the apparatus to a standby mode
   and monitor a ping signal from a wireless
   charger transmitter to detect whether the
   apparatus is removed from the wireless
   charger transmitter;
   enter a maintenance charging mode
   without sending the charging notification
   to the end user, when a voltage of the
   battery drops from the full voltage to
   below a recharging threshold; and
   continue the maintenance charging
   mode of the apparatus until the battery is
   charged to the full voltage or the
   apparatus is removed from the wireless
   charger transmitter.

Comment: Wireless charging is initiated by placing the device on the charging pad. This is indicated by a blue circle graphic on the screen, then a charging notification in the notification panel. Current to the battery is measured as 830mA.
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### 13.2 User interaction with a Mobile Device

A Mobile Device should indicate the following conditions to users:

- Successful reception of the Power Signal within 3 seconds after being placed on a Base Station.
- End of reception of the Power Signal.

Moreover, if the Power Receiver has transmitted an End Power Transfer Packet, the Power Receiver shall remain in the power transfer phase until the Power Transmitter removes the Power Signal. Furthermore, the Power Receiver should transmit additional End Power Transfer Packets if the Power Transmitter does not remove the Power Signal. For battery-charging applications, it is recommended that the Power Receiver sends an End Power Transfer Packet containing an End Power Transfer Code 0x01 on detecting that the battery is fully charged.

Comment: The Qi wireless charging standards stipulate that the device must indicate to the user when charging starts and stops, and that charging should be stopped when the phone detects that the battery is full. On our test device the notification indicates that the battery is charged to 100%.
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- continue the maintenance charging mode of the apparatus until the battery is charged to the full voltage or the apparatus is removed from the wireless charger transmitter.

Comment: Once the power transfer has been ended the charger enters the Ping mode, in which it repeatedly pings the mobile device. The device responds to each ping indicating that it doesn’t require any power and the charger remains in the ping mode.
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   continue the maintenance charging mode of the apparatus until the battery is charged to the full voltage or the apparatus is removed from the wireless charger transmitter.

Comment: The user notification indicates that the device is still detecting that is connected to the wireless charger. Although the notification says “Wireless Charging”, the right hand screen shot indicates that no current is actually being received.
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Comment: The above testing shows that once a device battery is charged it stops receiving charge until the battery voltage falls to a certain level then receives a small amount of charge to return it to above that level. The user is not aware of this charging process as the battery level is indicated at 100% the whole time.
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NOTE: If the Power Receiver remains in the power transfer phase, a situation could occur in which charging and power transfer indicators on the Mobile Device and Base Station, respectively, provide conflicting messages to the user. For example, the Mobile Device indicates that the battery is not charging but the Base Station indicates that power transfer is in progress. Note that the Power Receiver can restart power transfer after receiving a next Digital Ping from the Power Transmitter and the Power Receiver detecting that the charging level of the battery has dropped below some threshold.

At any time a user can remove a Mobile Device that is receiving power. The Power Transmitter can recognize such an event from a time-out in the communications from the Power Receiver, or from a violation of the Power Transfer Contract. As a result, the Power Transmitter aborts the power transfer and the system reverts to the selection phase.