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Wireless Keyboard Without Need For Battery

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Abstract: To obviate the need for a battery or other power source, a keyboard may transmit keystroke signals to a tablet computer via a passive antenna, such as a passive Near Field Communication (NFC) antenna and/or radio-frequency identification (RFID) antenna. The tablet computer may transmit signals to the keyboard via an active antenna such as an active NFC antenna and/or RFID antenna. When the user presses a key on the keyboard, the passive antenna may modulate the signal received from the tablet computer. The modulation of the signal may include completing and/or closing a circuit in response to the user pressing the key on the keyboard. The modulation of the signal may be unique to the keystroke, and/or combination of keystrokes, entered by the user. The tablet computer may receive the modulated signal and interpret the modulated signal as the keystroke entered by the user.

Tablet computers may be convenient in that they are easy to transport. Users may augment tablet computers with keyboards. The keyboards may physically support the tablet computers and wirelessly transmit keystroke signals to the tablet computers, so that the combination of the tablet computer and keyboard functions like a laptop computer.

To obviate the need for a battery or other power source, the keyboard may transmit the keystroke signals to the tablet computer via a passive antenna, such as a passive Near Field Communication (NFC) antenna and/or radio-frequency identification (RFID) antenna. The tablet computer may transmit signals to the keyboard via an active antenna such as an active NFC antenna and/or RFID antenna. When the user presses a key on the keyboard, the passive antenna may modulate the signal received from the tablet computer. The modulation of the signal may include completing and/or closing a circuit in response to the user pressing the key on the keyboard. The modulation of the signal may be unique to the keystroke, and/or combination of keystrokes, entered by the user. The tablet computer may receive the modulated signal and interpret and/or demodulate the modulated signal as the keystroke entered by the user.

FIG. 1A is a diagram of an example tablet computer ("tablet") 100. The tablet 100 may include a display 102. The display 102 may present images to the user. The display 102 may include a touchscreen display, which may receive input from the user by the user touching and/or stroking the display 102.

The tablet 100 may include a bezel 104 surrounding and/or enclosing the display 102. The bezel 104 may be made of a nonconductive material, such as plastic or glass, allowing electromagnetic radiation, such as wireless signals, to pass through the bezel 104. Other techniques may allow a conductive material, such as aluminium or stainless steel, to communicate wireless signals through the bezel 104.

The tablet 100 may also include a coil 106. The coil 106 may include an active antenna, such as an active NFC antenna and/or active RFID antenna, that transmits signals to an antenna of the keyboard. The coil 106 may also receive, and/or demodulate, modulated signals from the keyboard. The coil 106 may be considered an interrogator or reader that sends a signal to a tag, such as a tag described below with respect to FIG. 3, and reads the response of the tag. While the coil 106 is shown in the lower-right corner of the bezel 104 in FIG. 1A, the coil 106 may be included in any portion of the bezel 104 in which the coil 106 may or may not align with a corresponding coil of the keyboard.

The tablet 100 may also include magnets (not shown in FIG. 1A). The magnets may align with, and/or attract, magnets included in the keyboard. The attraction of the magnets in the tablet 100 to the magnets in the keyboard may retain the tablet 100 to the keyboard.

FIG. 1B is a diagram of an example keyboard 150. The keyboard 150 may include a frame 152 enclosing and/or supporting multiple keys 154. The frame 152 may be generally planar so that it easily rests on a table or other flat surface. The keys 154 may include alphanumeric and/or modifier keys.

The keyboard 150 may also include a backstop 156. The backstop 156 may be hingedly attached to the frame 152. The hinged attachment of the backstop 156 to the frame 152 may allow the backstop 156 to support the tablet 100 (not shown in FIG. 1B) in an angled position for ease of viewing by the user. The backstop 156 may include latches or another mechanism to lock the backstop 156 in the angled position with respect to the frame 152. The backstop 156 may be made of a nonconductive material, such as plastic, allowing electromagnetic radiation, such as wireless signals, to pass through the backstop 156. Other techniques may allow a conductive material , such as aluminium or stainless steel, for the backstop 156 to communicate wireless signals through.

The backstop 156 may include magnets (not shown in FIG. 1B). The magnets in the backstop 156 may align with, and/or attract, the magnets in the tablet 100. The alignment and/or attraction of the magnets in the backstop 156 to the magnets in the tablet may retain and/or hold the tablet 100 onto the backstop 156 of the keyboard 150.

The backstop 156 may include a coil 158. The coil 158 may be a passive antenna, such as a passive NFC antenna and/or a passive RFID antenna, that modulates and sends signals back to the coil 106 of the tablet 100. The signals may be modulated based on which key 154, and/or combination of keys 154, were pressed down by the user.

FIG. 1C is a diagram showing the tablet 100 resting on the keyboard 150 so that the combination of tablet 100 and keyboard 150 functions as a laptop computer. As discussed above, the magnets of the tablet 100 may be aligned with the magnets of the backstop 156, and the attraction of the magnets of the tablet 100 to the magnets of the backstop 156 may retain the tablet 100 onto the backstop 156.

The placement of the tablet 100 onto the backstop 156, and/or the alignment of the magnets of the tablet 100 to the magnets of the backstop 156, may cause and/or ensure, that the coil 106 of the tablet 100 is aligned with the coil 158 of the backstop 156. The alignment of the coil 106 of the tablet 100 to the coil 158 of the backstop 156 may minimize the distance between the coils 106, 158, minimizing the power required to transmit signals and reducing interference and noise between the coils 106, 158 for NFC communication. If RFID communication is chosen instead, the two coils may not be aligned. RFID makes an effort to give a long reading range, while NFC deliberately limits this range to only a few inches or almost touching the two devices containing the coils.

FIG. 2 is a diagram showing communication between the coil 106 of the tablet 100 and the coil 158 of the keyboard 150 and circuitry between the coil 158 of the keyboard and the keys 154 for modulating signals based on the user pressing one or more keys 154. Embedded within each key is a radio chip with a bit of storage memory, with the relevant key information, such as the character “A”. The keys 154 are coupled to the switches 254. As shown in FIG. 2, the coil 158 may receive signals sent and/or generated by the coil 106. The signal received by the coil 158 may induce a magnetic current within wires 202, 204 of the keyboard 150 (not shown in FIG. 2) when one or more of the keys 154 is pressed.

The keyboard 150 may include switches 254A, 254B, 254C, 254Z (collectively “switches 254”) corresponding to each key 154A, 154B, 154C, 154Z (collectively “keys 154”). The switches 254 may be in open positions until the user presses the corresponding key 154, at which point the switch 254 will close, completing the circuit between the wires 202, 204 allowing the respective radio chip to connect to the antenna coil 158 . The closing of the circuit between the wires 202, 204 may allow the current flowing through the wires 202, 204 to induce a magnetic field, sending a signal back to the coil 106.

The length of the circuit may vary based on which key 154, and/or combination of keys 154, were pressed and which corresponding switches 254 were closed. Pressing multiple keys 154 may result in multiple switches 254 being closed and parallel closed circuits. The length of the circuit, which results from which key 154 was pressed, may determine and/or modify the modulation of the original signal sent by the coil 106. The coil 106 may receive the modulated signal, and the tablet 100 (not shown in FIG. 2) may interpret the modulated signal to determine which key 154 was pressed.

FIG. 3 shows a key 154 with a wireless tag, such as an RFID tag, included in the key 154. The wireless tag may be powered by electromagnetic induction from the magnetic field and/or signal generated by the coil 106 (not shown in FIG. 2). The wireless tag may include an antenna and an integrated circuit.

In this example, the key 154 may include an antenna 302. The antenna 302 may be included in addition to, or instead of, the coil 158 described above. The antenna 302 may receive the signal from the coil 106 and, after the signal is modulated by an integrated circuit 306 (described below), transmit the modulated signal back to the coil 106.

The key 154 may include a spring contact 304. The spring contact 304 may be a flexible conductive material, such as metal. The spring contact 304 may be biased away from a contact 310, so that in a normal state when the key 154 is not depressed, the spring contact 304 is not in contact with the contact pad 310. When the key 154 is depressed and/or pressed by the user, the spring contact 304 may contact the contact pad 310, electrically coupling the spring contact 304 to the contact pad 310.

The contact pad 310 may be included in a rigid or flexible printed circuit board (PCB) 308. The contact pad 310 may be coupled to an integrated circuit (IC) 306 via a printed circuit board (PCB) 308.

The IC 306 may be powered by the current induced by the antenna 302 from the signal received from the coil 106. The IC 306 may store and process information, modulate and demodulate wireless and/or radio-frequency (RF) signals, such as modulating the signal received from the coil 106, and/or collect direct current power from the current induced from the signal received from the coil 106.

The antenna 302 may be disconnected and/or decoupled from the IC 306 until the user presses a key, preventing any signal from being read from the IC 306 when the key 154 has not been pressed. When the user presses the key 154, the spring contact 304 contacts the contact pad 310, completing the circuit between the antenna 302 and the IC 306. The IC 306 then transmits the signal indicating the character represented by the key 154 and/or IC 306. The IC 306 and/or antenna 302 may transmit the signal using, for example, modulated backscatter. Signals may be generated by multiple keys 154 and their corresponding ICs 306 based on multiple key presses.

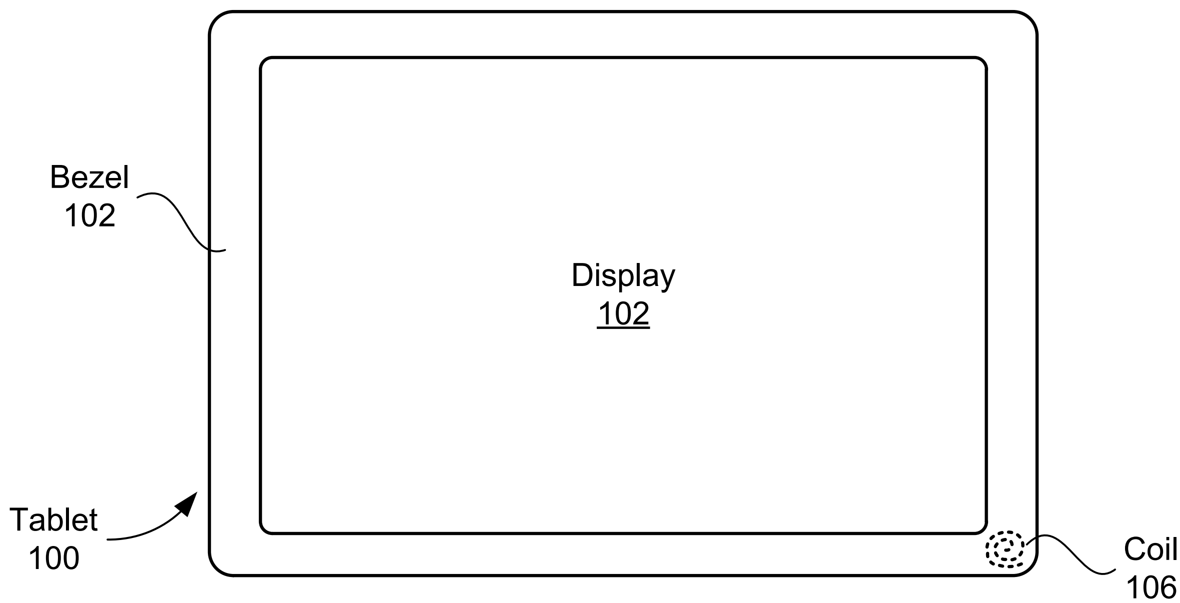
Bezel
102
Display
102
Tablet
100
Coil
106

FIG. 1A

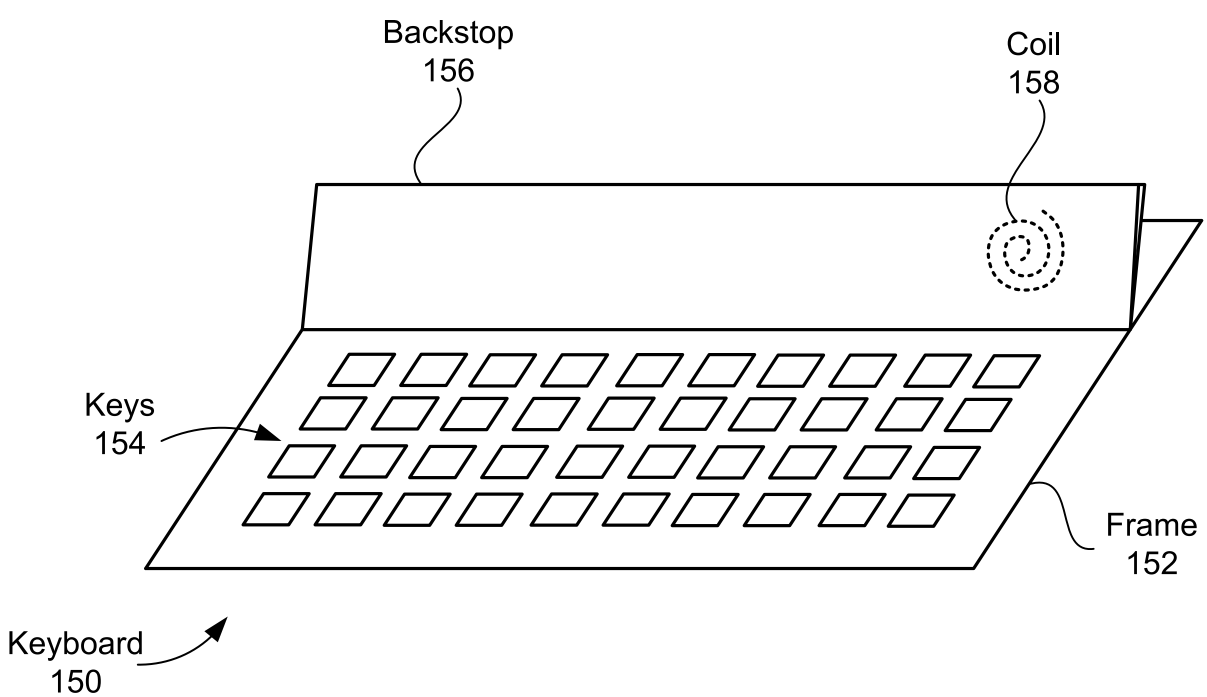
Backstop
156
Coil
158
Keys
154
Frame
152
Keyboard
150

FIG. 1B

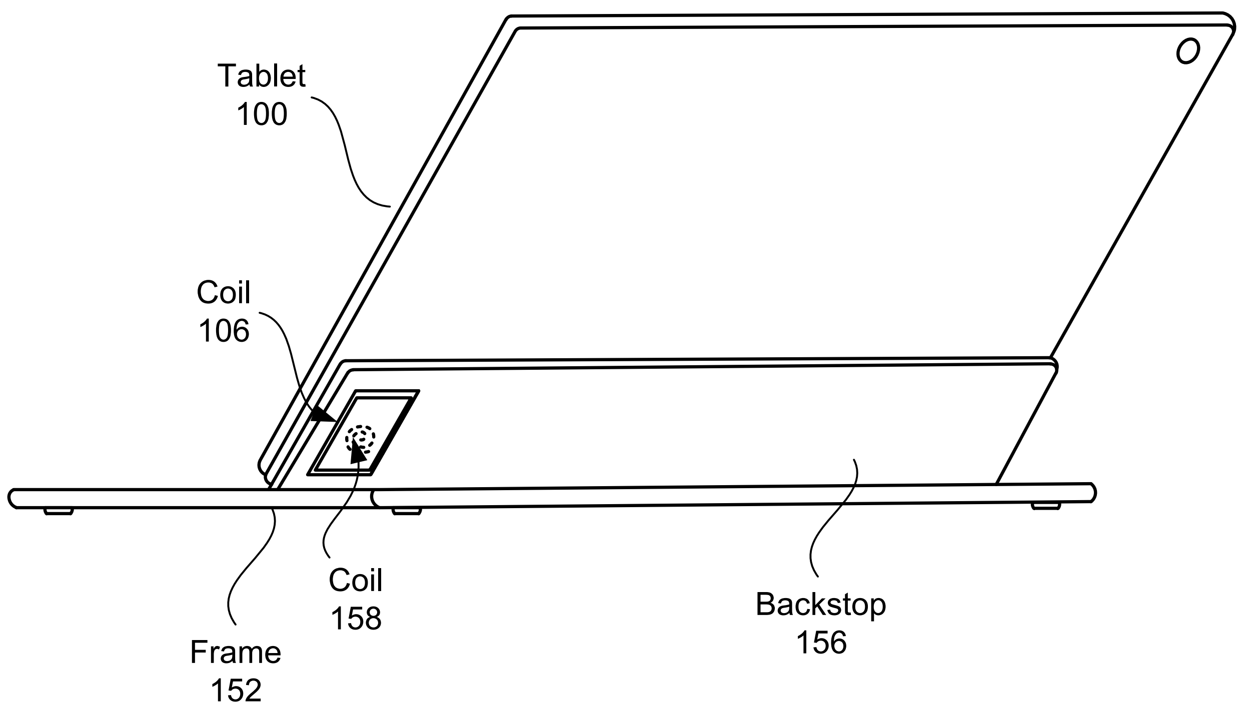

FIG. 1C

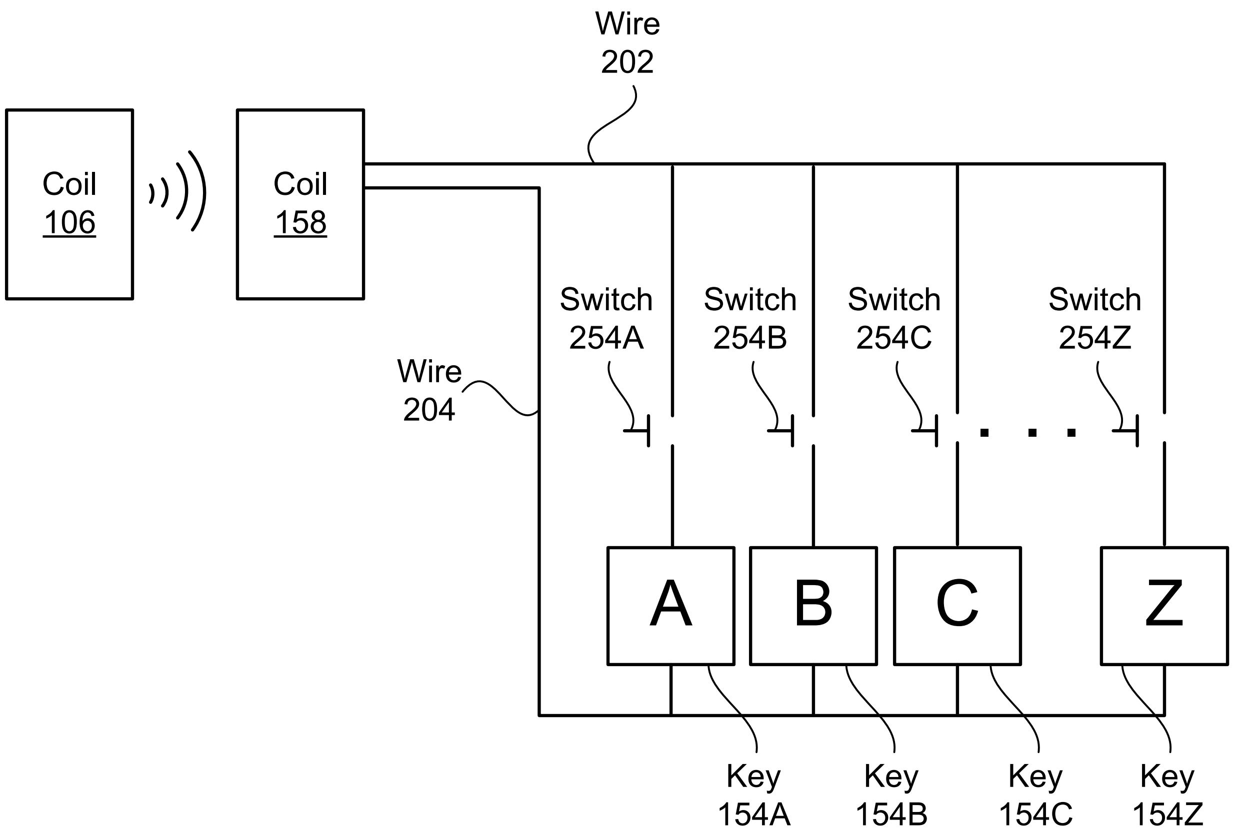
Wire
202
Coil
106
Coil
158
Switch
254A
Switch
254B
Switch
254C
Switch
254Z
Wire
204
A
B
C
Z
Key
154A
Key
154B
Key
154C
Key
154Z

FIG. 2

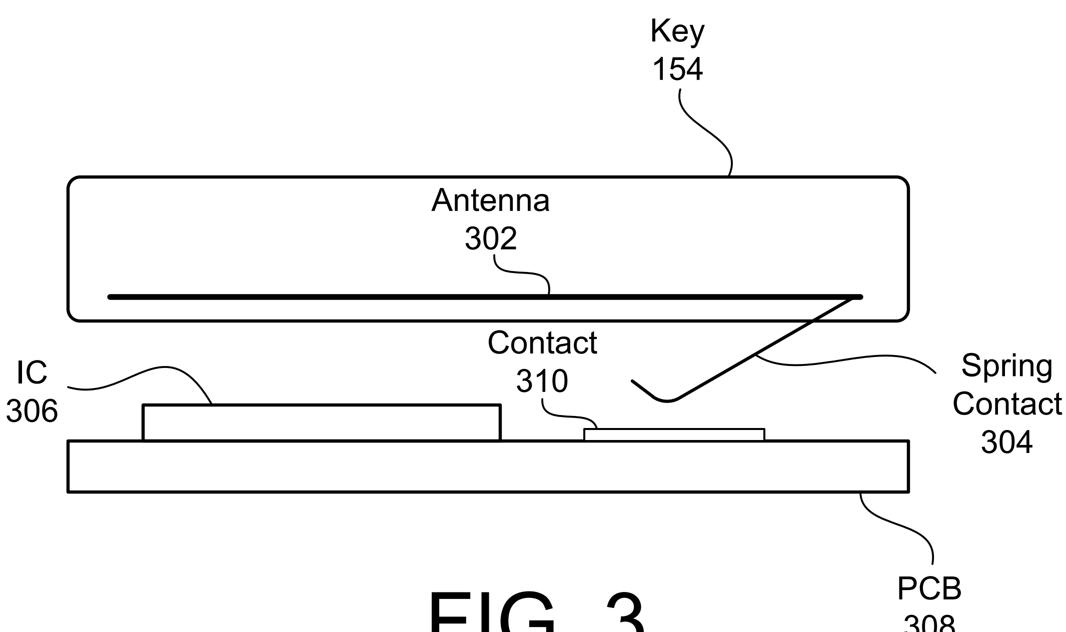
Key
154
Antenna
302
Contact
310
IC
306
Spring
Contact
304
PCB
308

FIG. 3