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APPLICATION NUMBER: 61/006,721

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET - Page 1 of 3

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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TITLE OF THE INVENTION (500 characters max):

Power Outlet Locator

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS (check all that apply)

☐ Application Data Sheet. See 37 CFR 1.76	☐ CD(s). Number of CDs: _____
☒ Drawing(s). Number of Sheets: <u>8</u>	☐ Other (specify): _____
☒ Specification (e.g. description of the invention). Number of Pages: <u>12</u>	

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Date 29th January 2008

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Docket Number 1052-17

Power Outlet Locator

Field of the Invention

The present invention is directed to providing electrical power outlets. More specifically, the present invention relates to induction type power outlets.

5 Background

Power outlets are generally visible. Conventional electrical sockets have holes therein into which the pins of corresponding plugs are inserted to form a conductive coupling. The holes of the sockets are easy to see with the naked eye.

For safety, the power supplying side of a conductive couple is generally the
10 female part, and does not have bare conductive elements protruding there from. A plug coupled to the device is the corresponding male part with bare pins. The size of the pins and holes are such that a child cannot insert his or her fingers thereinto. In high quality sockets, an earth connection is provided, and, only when a plug with a longer earth pin is inserted there into, is it possible to insert a pin (or anything else)
15 into the holes connected to the current carrying live and neutral wires. Nevertheless, socket holes are dangerous and children do sometimes manage to insert pencils, pins and other objects into socket holes, sometimes with fatal results. Water can also cause shorting and may result in electrocution.

It can therefore be safer and more reliable to provide socketless power outlets
20 such as inductive couplers. Inductive power coupling allows energy to be transferred from a power supply to an electric load without connecting wires. A power supply is wired to a primary coil and an oscillating electric potential is applied across the primary coil which induces an oscillating magnetic field. The oscillating magnetic field may induce an oscillating electrical current in a secondary coil, placed close to
25 the primary coil. In this way, electrical energy may be transmitted from the primary coil to the secondary coil by electromagnetic induction without the two coils being conductively connected. When electrical energy is transferred inductively from a primary coil to a secondary coil, the pair are said to be inductively coupled. An electric load wired in series with such a secondary coil may draw energy from the
30 power source when the secondary coil is inductively coupled to the primary coil.

By not requiring holes for coupling pins, socketless outlets may be disguised more effectively and are less obtrusive. A primary inductive coil, for example, may be

concealed behind a surface. Generally, the fact that socketless outlets are less obtrusive is advantageous. But being harder to spot than conventional power outlets has its disadvantages. The user must somehow locate the outlet before being able to use it by bringing a secondary coil into proximity therewith. The problem of locating
5 such sockets is particularly acute where the power outlets are behind a concealing surface such as a desk top or wall, and the positions thereof are adjustable, by being repositionable.

Where the position of a power outlet is adjustable by being mounted on a track or arm, within a wall cavity or hollow work surface, and where the surface is opaque,
10 it is not possible to indicate the position of such power outlets by making indicative marks on the concealing surface.

There is therefore a need for a means of locating concealed power outlets and the present invention addresses these needs.

Summary of the Invention

In accordance with a first aspect, the present invention is directed to providing a power outlet locator for locating an inductive power outlet, the power outlet comprising at least one primary coil wired to a power supply for inductively coupling
5 with a secondary coil wired to an electrical device. Typically, the power outlet locator comprises at least one sensor for detecting the at least one power outlet, at least one processor for receiving a sensor signal from the at least one sensor and computing at least one coordinate of a location of the at least one power outlet and at least one user interface for receiving a signal from the processor and communicating the location to
10 a user.

Preferably, at least one sensor is selected to detect radiation transmitted by at least one the power outlet. Typically, at least one sensor is selected to detect an electromagnetic field generated by at least one the primary coil.

Optionally the processor calculates the distance between the sensor and the
15 power outlet by comparing the intensity of the radiation received by the sensor with a reference value. Typically, the processor determines the direction to the power outlet by comparing the relative intensities of the radiation detected by a plurality of the sensors.

Alternatively the location of the power outlet is encoded into a signal
20 transmitted by the power outlet and decoded by the processor.

Typically, the user interface comprises a visual display. Optionally, the visual display indicates the direction of the power outlet. Preferably, the visual display indicates the distance to the power outlet.

Preferably, the visual display comprises a graphical user interface representing
25 at least a section of a target comprising concentric rings centered on a point indicating the location of the power outlet. Typically, the power outlet is concealed behind a surface and the target is superimposed upon an image of the surface.

Optionally, the user interface comprises an audible signal.

Another aspect of the invention is to provide an electrical device incorporating
30 a power outlet locator. Typically, the electrical device additionally comprises at least one the secondary inductive coil for powering the electrical device. Optionally, the

electrical device additionally comprising at least one electrochemical power cell for powering the electrical device and at least one the secondary inductive coil wired to the electrochemical cell via a rectifier for charging the electrochemical power cell.

- 5 The electrical device may be selected from the group comprising: telephones, personal digital assistants (PDAs), cameras, media players, computers, keyboards and mice.

Brief Description of the Figures

For a better understanding of the invention and to show how it may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings.

5 With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no
10 attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention; the description taken with the drawings making apparent to those skilled in the art how the several forms of the invention may be embodied in practice. In the accompanying drawings:

15 Fig. 1a is a schematic representation of a power outlet locator according to one embodiment of the invention being used to indicate the location of an inductive power outlet concealed behind a surface;

 Fig. 1b is a schematic representation of a computer standing on the surface of Fig. 1a and being powered by the concealed primary outlet;

20 Fig. 2 is a block diagram representing the main features of the power outlet locator according to a second embodiment of the invention;

 Fig. 3 is a schematic representation of a power outlet locator with four sensors according to a third embodiment of the invention;

25 Fig. 4 is a block diagram representing a power outlet locator according to a fourth embodiment of the invention configured to receive and decode a signal transmitted by a power outlet, and

 Fig. 5a-c are schematic representations of a mobile phone incorporating a power outlet locator, according to a fifth embodiment of the invention, wherein a graphical user interface represents a virtual target superimposed over an image of the surface.

30

Description of the Preferred Embodiments

Reference is now made to Fig. 1a showing a schematic representation of a power outlet locator 1100 according to a first embodiment of the invention. The location of an inductive power outlet 1200, concealed behind a surface 1240, is indicated by an arrow 1162 displayed upon a visual user interface 1160.

The inductive power outlet 1200 is wired to a power source typically via a controller (not shown) providing the electronics necessary to drive the inductive power outlet 1200. Driving electronics may include a switching unit providing a high frequency oscillating voltage supply, for example.

The inductive power outlet 1200 may be incorporated into a vertical surface such as a wall of a building or a cabinet. The inductive power outlet 1200 may be concealed behind a surface 1240 of wallpaper or stretched canvas for example. Alternatively the inductive power outlet 1200 may be incorporated behind a facing layer of a horizontal platform such as a desk-top, a kitchen work-top, a conference table or a work bench for example of mica, Formica or wood veneer. Alternatively, again, an inductive power outlet 1200 may be concealed beneath flooring such as rugs, fitted carpet, parquet, linoleum, floor tiles, tiling, paving and the like.

It will be apparent that when the location of the inductive power outlet 1200 is known, a secondary coil 1280 may be brought into alignment with it, as shown in Fig. 1b. Thus the inductive power outlet 1200 may inductively couple with the secondary coil 1280 and thereby power an electrical device, such as a computer 1282, wired to the secondary coil 1280. It is noted that according to some embodiments, the electrical device, such as a computer 1282 may itself incorporate an integral inductive power outlet locator.

With reference now to Fig. 2, a block diagram is shown representing the main functional components of a power outlet locator 2100 according to a second embodiment of the invention. A sensing unit 2120 is configured and operable to detect an inductive power outlet 2200. A processor 2140, in communication with the sensing unit 2120, is configured to compute the location of the power outlet locator 2100. A user interface 2160 is provided for communicating the computed location to a user.

According to various embodiments, the sensor unit 2120 may incorporate magnetic sensors such as Hall probes, for example, configured to detect the magnetic field generated by the inductive power outlet directly. Alternatively, the sensor unit 2120 may incorporate a radio receiver for receiving a radio signal transmitted from the power outlet. It will be appreciated, however, that appropriate sensors may be selected for detecting specific electromagnetic wavelengths, including ultra-violet radiation, micro waves, radio waves or even x-ray or shorter wavelengths. Furthermore, the sensing unit may be configured to receive other types of radiation, including mechanical vibrations such as both audible and inaudible (e.g. ultrasonic) sound waves.

An exemplary sensing unit 3120 is represented in Fig. 3 according to a third embodiment of the invention. Four sensors 3122a-d, such as proximity sensors based or volume sensors, infra-red sensors, ultrasonic sensors, magnetic sensors (like Hall probes), inductance sensors, capacitance sensors or the like, are arranged in a diamond configuration 3124.

Each sensor 3122 is configured to receive a transmission signal T transmitted from an inductive power outlet 3200. The processor 3240 may compare the intensity I of the transmission signal T detected by a sensor 3122 with a reference value I_r to indicate the distance between the sensor 3122 and the power outlet 3200.

Furthermore, the diamond configuration 3124, provides two perpendicular opposing pairs of sensors 3122a-b, 3122c-d. The intensity I of the transmission signal T is measured by each sensor independently. The processor 3140 may use the differences between intensities measured by opposing pairs ($I_a - I_b$), ($I_c - I_d$) to provide vector coordinates indicating the direction of the power outlet 3200. Although a two dimensional vector is computed using the two dimensional diamond configuration of sensors described hereinabove, it will be appreciated that a three dimensional vector may be computed from three pairs of sensors in a tetrahedral configuration.

The computation method herein described is for illustrative purposes only, alternative methods by which the processor may compute the direction of the power outlet will be familiar to the man of the art.

Fig. 4 shows a block diagram representing a power outlet locator 4100 according to a fourth embodiment of the invention.

5 An inductive power outlet 4200 transmits a transmission signal T which carries an encoded location signal S identifying the location of the inductive power outlet 4200. A primary coil 4208 is connected to a power supply 4202 via a switching unit 4204 and a microcontroller 4206. The switching unit 4204 is configured to intermittently connect the power supply 4202 to the primary coil 4208 with a bit-rate frequency f . The location of the primary coil 4208 is encoded into a location signal S which is sent to the microcontroller 4206. The microcontroller 4206 is configured to
10 modulate the bit-rate signal with the location signal S.

The voltage applied to the primary coil 4208 is thus a modulated variable voltage with a frequency f , carrying an encoded location signal S. It will be appreciated that the variable voltage may produce a radio wave of frequency f which may be transmitted as a transmission signal T. Alternatively, the transmission signal T
15 may be transmitted by a dedicated transmitter separate from the primary coil 4208.

The power outlet locator 4100 includes a receiver 4120, a clock 4142 and a cross-correlator 4144. The radio receiver 4120 is tunable to receive radio waves of frequency f , such that it may receive the transmission signal T. The clock 4142 produces a fixed reference signal R of frequency f . The cross-correlator 4144 receives
20 both the reference signal R from the clock 4142 and the transmission signal T from the receiver 4120 and by cross-correlating these signals the location signal S is isolated.

Although a digital bit-rate modulated transmission signal T is described in the fourth embodiment hereinabove, it will be appreciated that the transmission signal T
25 may alternatively be modulated in other ways such as by analogue or digital frequency modulation or by amplitude modulation, for example.

The location of the power outlet 4200 may thereby be transmitted to a remote power outlet indicator 4100, which may then output the location of the power outlet 4200 a user interface.

30 A power outlet locator 5100, according to a fifth embodiment of the invention is incorporated within a mobile phone 5282 as shown in Figs. 5a-c. A graphical user interface 5160, displayed upon the visual display 5284 of the mobile phone 5282,

represents a virtual target 5162, centered upon the power outlet (not shown) and superimposed over the surface 5240 behind which the power outlet is concealed. The section 5161a-c of the virtual target 5162 visible in the visual display 5284 of the mobile phone 5282 depends upon the location of the mobile phone 5282. Thus the curvature of the visible concentric arcs may indicate both the direction and distance to the power outlet.

It will be appreciated that the virtual target 5162 may be displayed upon a blank background or alternatively may be superimposed upon an image of the surface 5240, for example produced in real time by the camera (not shown) of the mobile phone 5162.

It is further noted that the mobile phone 5282 may itself carry a secondary inductive coil (not shown) wired to a electrochemical cell via a rectifier for inductively coupling with the inductive power outlet 5100 and charging the electrochemical power cell. Optimal alignment between the secondary coil and the inductive power outlet 5100 may additionally be indicated by an audible signal such as a ringtone or the like. In other embodiments, particularly useful for the visually impaired, an audible signal may guide the user to the power outlet, perhaps verbally or alternatively through other variations in pitch, volume or timbre.

It will be apparent that in certain situations such as when the power source of the mobile phone 5162 is completely devoid of power, the power outlet locator 5100 of the fifth embodiment, which draws power from the mobile phone 5282, is impractical.

In alternative embodiments, therefore, a power outlet locator may be independently powered with a user interface independent from the visual display 5284 of the mobile phone 5282. For example, in another embodiment of the invention, a power outlet locator draws power from a secondary inductive coil or other power source. The relative brightness of four light emitting diodes mounted upon the corners of the mobile phone may indicate both the direction and proximity to a primary coil.

Whilst the power outlet locator 5100 of the fifth embodiment is incorporated into a mobile phone it is noted that such a power outlet locator may alternatively be incorporated within other electrical devices such as fixed telephones, personal digital assistants (PDAs), cameras, media players, computers, keyboards, mice and the like.

The scope of the present invention is defined by the appended claims and includes both combinations and sub combinations of the various features described hereinabove as well as variations and modifications thereof, which would occur to persons skilled in the art upon reading the foregoing description.

- 5 In the claims, the word "comprise", and variations thereof such as "comprises", "comprising" and the like indicate that the components listed are included, but not generally to the exclusion of other components.

Claims

1. A power outlet locator for locating an inductive power outlet, said power outlet comprising at least one primary coil wired to a power supply for inductively coupling with a secondary coil wired to an electrical device, wherein said power outlet locator comprises:
 - a. at least one sensor for detecting said at least one power outlet;
 - b. at least one processor for receiving a sensor signal from said at least one sensor and computing at least one coordinate of a location of said at least one power outlet; and
 - c. at least one user interface for receiving a signal from said processor and communicating said location to a user.
2. The power outlet locator of claim 1 wherein said at least one sensor is selected to detect radiation transmitted by at least one said power outlet.
3. The power outlet locator of claim 2 wherein said at least one sensor is selected to detect an electromagnetic field generated by at least one said primary coil.
4. The power outlet locator of claim 2 wherein said processor calculates the distance between said sensor and said power outlet by comparing the intensity of said radiation received by the sensor with a reference value.
5. The power outlet locator of claim 2 wherein said processor determines the direction to said power outlet by comparing the relative intensities of said radiation detected by a plurality of said sensors.
6. The power outlet locator of claim 2 wherein the location of said power outlet is encoded into a signal transmitted by said power outlet and decoded by said processor.
7. The power outlet locator of claim 1 wherein said user interface comprises a visual display.
8. The power outlet locator of claim 7 wherein said visual display indicates the direction of said power outlet.
9. The power outlet locator of claim 7 wherein said visual display indicates the distance to said power outlet.

10. The power outlet locator of claim 7 wherein said visual display comprises a graphical user interface representing at least a section of a target comprising concentric rings centered on a point indicating the location of the power outlet.
11. The power outlet locator of claim 7 wherein said power outlet is concealed behind a surface and said target is superimposed upon an image of said surface.
12. The power outlet locator of claim 1 wherein said user interface comprises an audible signal.
13. An electrical device incorporating said power outlet locator of claim 1.
14. The electrical device of claim 13 additionally comprising at least one said secondary inductive coil for powering said electrical device.
15. The electrical device of claim 13 additionally comprising at least one electrochemical power cell for powering said electrical device and at least one said secondary inductive coil wired to said electrochemical cell via a rectifier for charging said electrochemical power cell.
16. The electrical device of claim 13 being selected from the group comprising: telephones, personal digital assistants (PDAs), cameras, media players, computers, keyboards and mice.

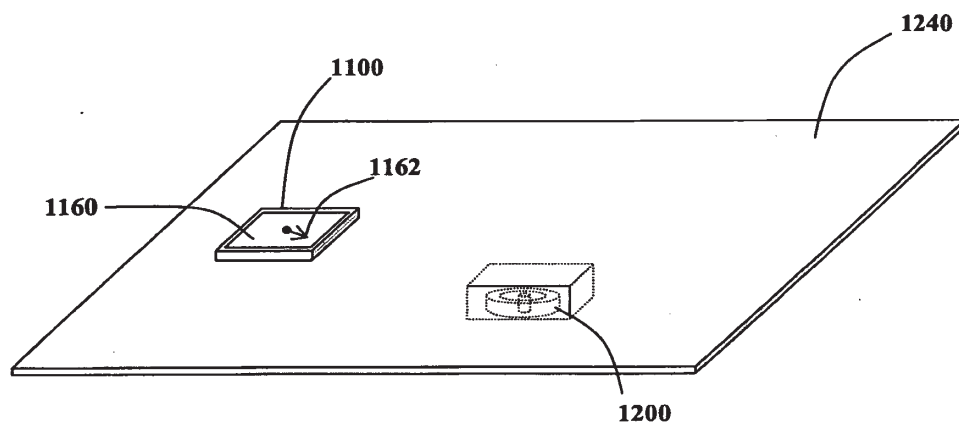


Fig. 1a

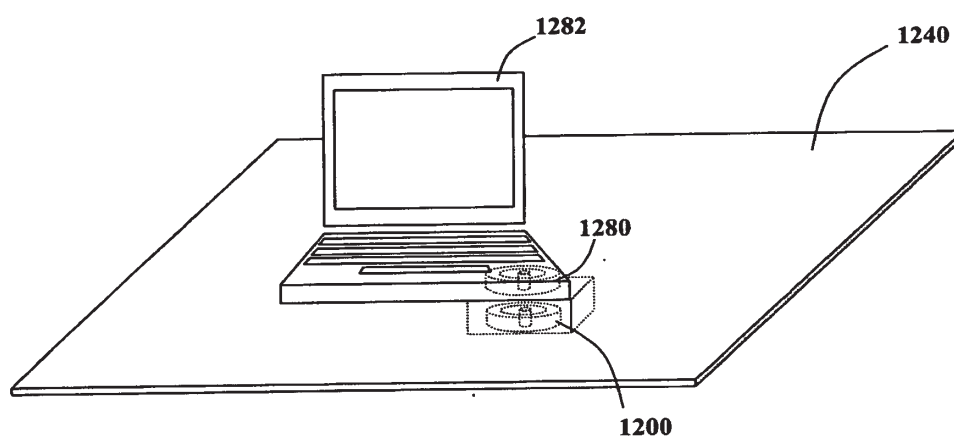


Fig. 1 b

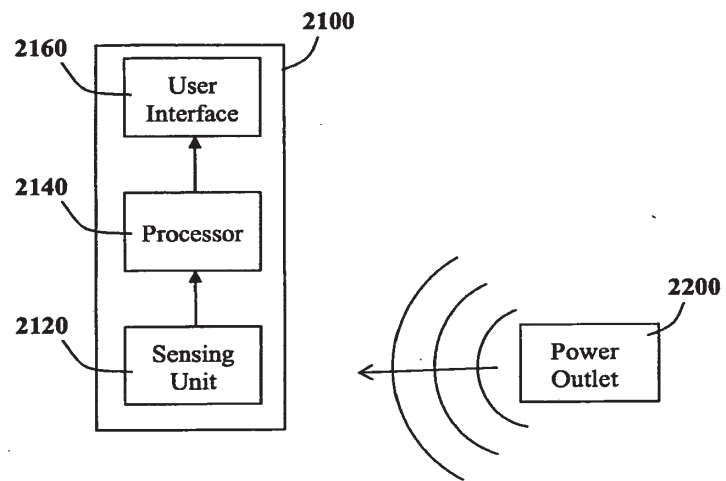


Fig. 2

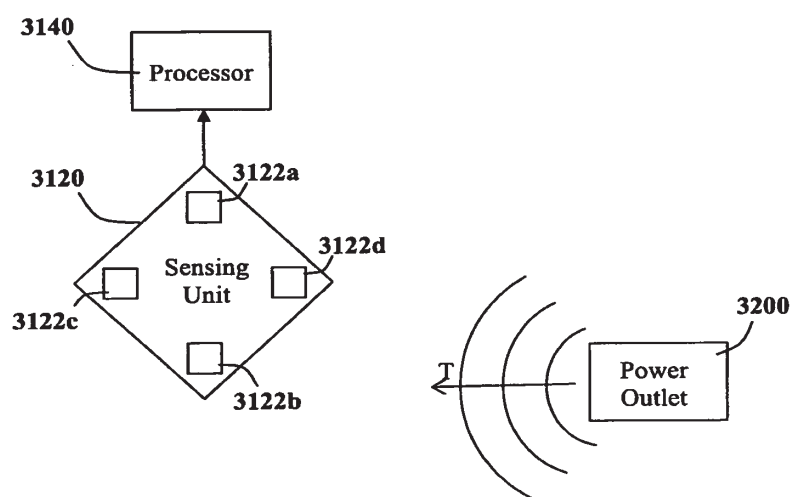


Fig. 3

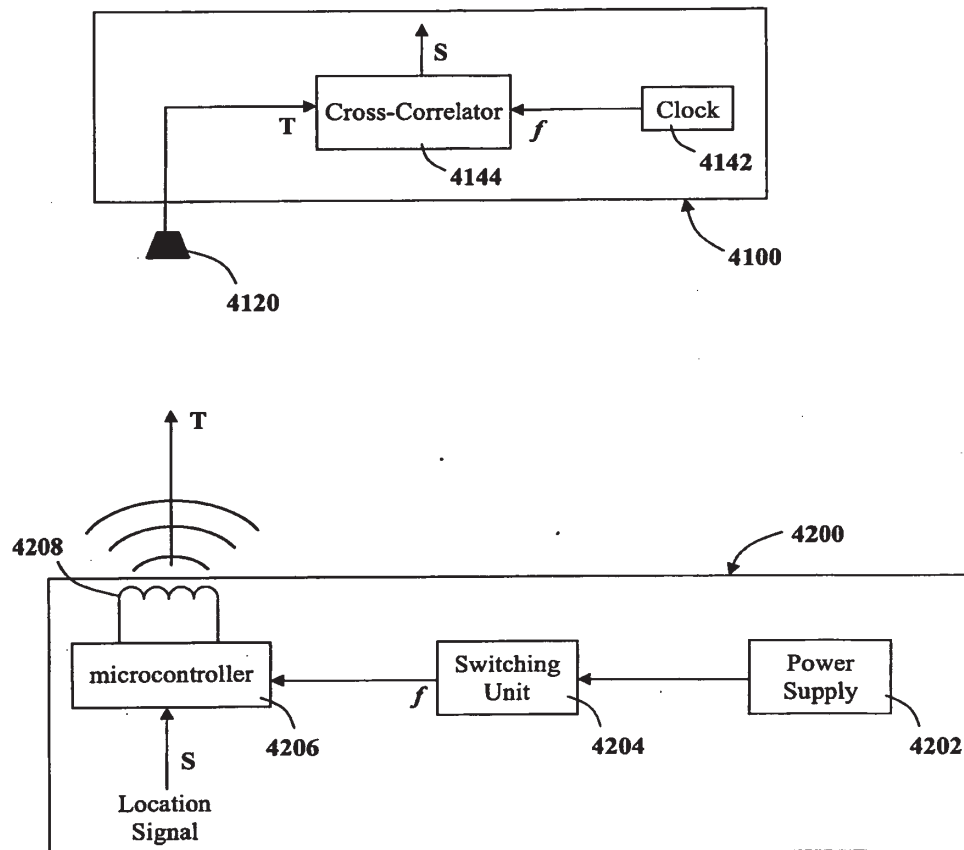


Fig. 4

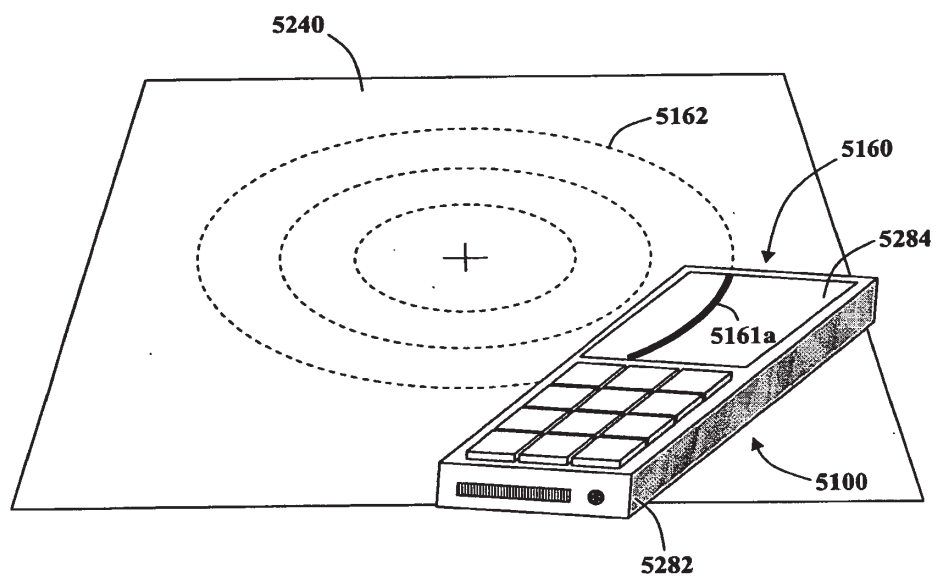


Fig. 5a

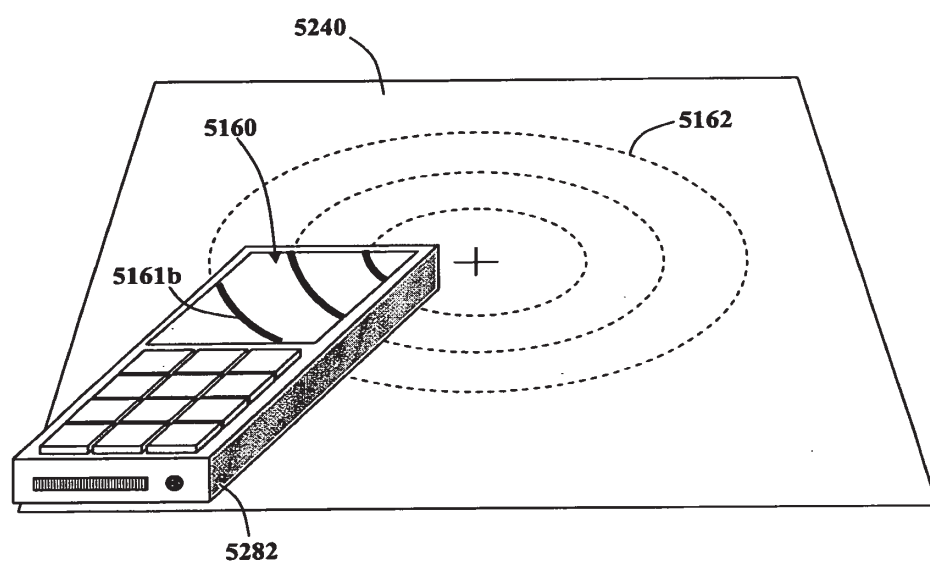


Fig. 5b

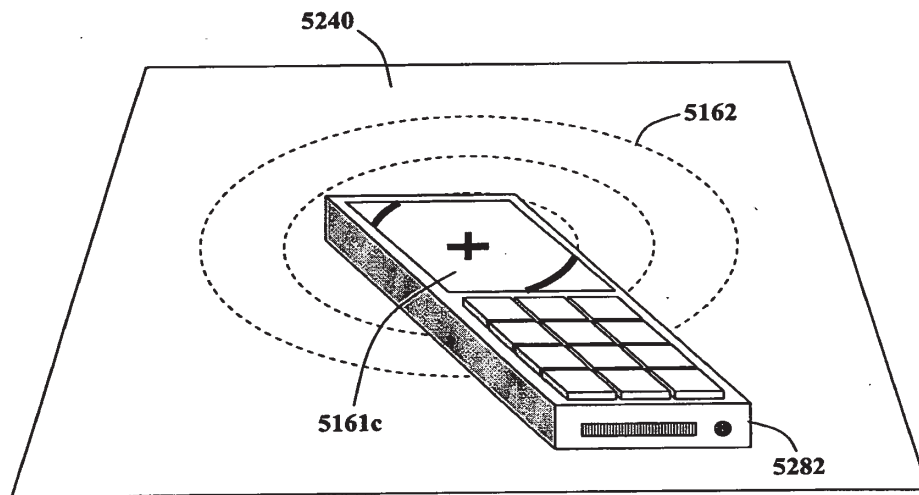


Fig. 5c