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(54) Title: POLICE AND SECURITY CAMERA SYSTEM UTILIZING WIRELESS ENERGY TRANSFER

(57) Abstract: Base units, sensors, cameras, and systems and methods for wireless energy transfer are described. In an example system, a firearm holster includes a wireless energy transfer base unit configured to cause a transmitter to selectively transmit power to the firearm or a component thereof (e.g., a camera connected to the firearm) when the firearm is placed in the firearm holster.

FIG. 16
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

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POLICE AND SECURITY CAMERA SYSTEM

POLICE AND SECURITY CAMERA SYSTEM UTILIZING WIRELESS ENERGY TRANSFER

CROSS-REFERENCE TO RELATED APPLICATIONS

[001] This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/097,212 entitled "POLICE SYSTEM WITH AUTOMATIC CAMERA ACTIVATION", filed December 29, 2014. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

[002] This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/097,954 entitled "POLICE SYSTEM WITH AUTOMATIC CAMERA ACTIVATION & DISPLAY", filed December 30, 2014. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

[003] This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/104,504 entitled "ENHANCED POLICE SYSTEM WITH AUTOMATIC CAMERA ACTIVATION & DISPLAY", filed January 16, 2015. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.


[005] This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/113,622 entitled "ENHANCED POLICE AND SECURITY CAMERA SYSTEMS USING HIGHLY RESONANT COUPLING", filed February 9, 2015. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

February 16, 2015. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/127,789 entitled "HIGHLY RESONANT COUPLED POLICE AND SECURITY CAMERA SYSTEMS", filed March 3, 2015.

The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/154,023 entitled "POLICE AND SECURITY CAMERA SYSTEM CAPABLE OF WIRELESS ENERGY TRANSFER", filed April 28, 2015.

The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/173,754 entitled "ROBUST POLICE AND SECURITY CAMERA SYSTEM CAPABLE OF WIRELESS ENERGY TRANSFER", filed June 10, 2015. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/186,297 entitled "POLICE AND SECURITY CAMERA SYSTEM UTILIZING WIRELESS ENERGY TRANSFER", filed June 29, 2015.

The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.

This application claims the benefit under 35 U.S.C. § 119 of the earlier filing date of U.S. Provisional Application 62/190,857 entitled "POLICE AND SECURITY CAMERA SYSTEM UTILIZING WIRELESS ENERGY TRANSFER COMPRISING ENERGY HARVESTING", filed July 6, 2015. The aforementioned provisional application is hereby incorporated by reference in its entirety, for any purpose.
This application hereby incorporates by reference in its entirety, for any purpose
U.S. Non-Provisional Utility Application Number 14/969,455, entitled "WIRELESS POWER BASE UNIT AND A SYSTEM AND METHOD FOR WIRELESSLY CHARGING DISTANCE SEPARATED ELECTRONIC DEVICES", filed December 15, 2015.

TECHNICAL FIELD

The present disclosure relates to systems and methods for police and security cameras utilizing wireless energy transfer.

BACKGROUND

Police and security cameras have limitations. For example, the user must remember to activate the camera for it to begin recording. If the camera is left on for a wearer's entire shift, then the amount of data to be stored, cataloged, and/or reviewed may be impractically large. In addition, during use a body camera may be pointed away from an area of interest, which may result in important information being omitted from a recording. Further, police and security officers desire electronic wearable devices that are small enough to not interfere with their tasks. Existing police and security camera systems may be too bulky to be effective. There is a need for a more efficient and effective way of capturing and transmitting data (e.g., video, images, and audio) for law enforcement.

SUMMARY

Examples of base units, systems and methods for wireless energy transfer are described. In an example, a firearm includes a camera attached to the firearm and a sensor electrically coupled to the camera and configured to detect whether the firearm is in a stored configuration. The camera may be configured to inductively receive power when the firearm is in the stored configuration. The camera may be further configured to record data responsive to the sensor detecting the firearm is not in the stored configuration. In an example, the camera is configured to cease recording data stored configuration. In an example, the camera is configured to cease recording data
responsive to the sensor detecting that the firearm is in the stored configuration. The
responsive to the sensor detecting that the firearm is in the stored configuration. The
camera may comprise a receiver configured to receive wireless power from a distance-
separated transmitter. The stored configuration may include, for example, the firearm
being secured by a holster, a firearm rack, a firearm safe, or a strap. The sensor may
be, for example, a UV sensor, a photosensor, a pressure sensor, or a motion sensor.
The camera may be configured to harvest energy for power, for example, Wi-Fi energy.
and/or radio frequency energy. In an example, the recorded data may include one or
more of: image capture data, audio capture data, geo-location data, and/or time and date
data.

A firearm holster, in some examples, may include a housing enclosing the
transmitter, the battery, the controller, the receiver, and the memory; and wherein the
transmitter may comprise a coil comprising a magnetic core. The coil of the transmitter may be inductively coupled to a coil of the camera when the firearm is placed in the firearm holster. In an example, a coil of the camera when the firearm is placed in the firearm holster. In an example, the receiver may be further configured to receive a signal from a sensor; and the
receiver may be further configured to receive a signal from a sensor; and the
camera may be configured to harvest energy for power, for example, Wi-Fi energy.
and/or radio frequency energy. In an example, the recorded data may include one or
more of: image capture data, audio capture data, geo-location data, and/or time and date
data.
battery and the transmitter and configured to cause the transmitter to selectively transmit power from the battery to the camera. The headwear may further include a receiver configured to receive sensed data from the camera and memory configured to store the received, sensed data.

In an example, the headwear may further include a housing enclosing the transmitting coil for a base unit in accordance with the present disclosure;

figure 1 illustrates a block diagram of a system according to examples of the present disclosure; and

figure 2 illustrates an example of a receiving coil for an electronic device and a transmitting coil for a base unit in accordance with the present disclosure;

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a block diagram of a system according to examples of the present disclosure;
FIG. 3 illustrates a block diagram of a base unit according to examples of the present disclosure;

FIG. 4 illustrates a flow chart of a process according to examples herein;

FIG. 5 illustrates a flow chart of a process according to further examples herein;

FIGS. 6A and 6B illustrate views of a base unit having a housing according to examples of the present disclosure;

FIG. 7A-C illustrate arrangements of transmitting coils of base units according to examples of the present disclosure;

FIG. 8A-C illustrate arrangements of transmitting coils of base units according to further examples of the present disclosure;

FIG. 9 illustrates a base unit in the form of a puck in accordance with further examples herein;

FIG. 10 illustrates an example transmitter and receiver configuration in accordance with the present disclosure;

FIG. 11 illustrates: simulation results of wireless power transfer systems according to some examples of the present disclosure;

FIG. 12 illustrates: simulation results of wireless power transfer systems according to further examples of the present disclosure;

FIG. 13 illustrates a comparison between wireless power transfer systems and Q standard systems according to some examples of the present disclosure and Q standard systems;

FIG. 14 illustrates magnetic field lines of inductively coupled transmitting and receiving coils in accordance with some examples herein;

FIG. 15 illustrates a wireless camera system, including a base unit, a camera, and a sensor, according to some examples of the present disclosure;

FIG. 16 illustrates an example wireless camera system, including a firearm, a holster, base unit, a camera, and a sensor;

FIG. 17 illustrates an example wireless camera system, including a flashlight, a base unit, a camera, and a sensor;

FIG. 18 illustrates an example wireless camera system, including headgear, a base unit, and a sensor;

FIG. 19 illustrates an example wireless camera system, including headgear, a base unit, and a sensor;
FIG. 20 illustrates an example wireless camera system, including a user, a firearm, a holster, a flashlight, headgear, cameras, and a base unit; and FIG. 21 illustrates a flow chart of a process of using a base unit, sensors, and a camera in accordance with further examples herein.

DETAILED DESCRIPTION

According to some examples herein, a wireless camera system, and more specifically a wireless camera system utilizing wireless power transfer (e.g., weakly resonant system with relatively broad resonance amplification with moderate frequency dependence), is described. In an example, a camera may be mounted on a firearm, a flashlight, headgear or other articles worn by law enforcement, security personnel, or others. The camera may be powered wirelessly by a remote base unit. The base unit may receive a state from a sensor (e.g., a sensor mounted on the device to which the camera is mounted, and selectively wirelessly power the camera based on the state. The camera may be configured to automatically record and transmit data when it is powered.

In accordance with some examples of wireless power transmission disclosed herein, dependence on the relative sizes of the inductive coils and orientation between the coils may be reduced as compared to such dependence on coil sizes and orientation typically found in commercially available systems with strong resonant coupling at Q factors exceeding 100. In some examples according to the present disclosure, wireless power transfer systems may operate at Q values less than 100. Q value may be expressed as \( Q = \frac{1}{\sqrt{RL}} \) where \( R \) is resistance, \( L \) is inductance, \( C \) is capacitance.

The camera system may also be expressed as \( Q = \frac{1}{\sqrt{RL}} \) where \( \omega_0 \) is frequency and \( \Gamma \) is a loss factor and equal to \( R/L \).
Unlike commercially available wireless power systems, which typically use air core coils, according to some examples herein, the shape of the magnetic field between the coils may be augmented, for example, by using a medium with high permeability such as ferrite. According to some examples, guided flux or partially guided flux may be used to improve the performance of the system in a given orientation. An appropriate frequency, for example a body safe frequency, is used for power broadcast. The broadcast frequency may be tuned to reduce losses that may result from shielding. The broadcast frequency may be tuned to reduce losses that may result from shielding effects.

According to some examples herein, wireless magnetic resonance energy, resonant inductive coupling, or electromagnetic induction may refer to near field resonant inductive coupling, or electromagnetic induction may refer to near field wireless transmission of electrical energy between coils that are tuned to resonate at substantially the same frequency. Resonant transfer may use a coil ring with an oscillating current to generate an oscillating magnetic field. If the coil is highly resonant, then energy placed in the coil may die away relatively slowly over many cycles, but if a second coil is brought near it, the coil can pick up most of the energy beforehand if it is some distance away. The energy received may be stored in an energy storage unit, such as a super capacitor. In an example, the super capacitor may be capable of storing electrical energy up to 15-35 watt-hour/kilogram of its weight. The stored energy can be utilized by an electronic device when required, and at a reduced voltage, required for its routine operation. In an example, the system consists of a range required for its routine operation. In an example, the system consists of transmitters and receivers that contain magnetic loop antennas critically tuned to the same frequency. In another example, the system may include transmitters and receivers that contain a magnetic loop antenna tuned to the same frequency. In another example, the system may include transmitters and receivers that contain magnetic loop antennas critically tuned to the same frequency. Unlike the that contain magnetic loop antennas critically tuned to the same frequency. Unlike the far field wireless power transmission systems based on traveling electromagnetic waves, examples described herein may provide for resonant inductive coupling through magnetic fields similar to those found in transformers except that the primary coil and secondary winding may be physically separated, and tuned to resonate to increase their magnetic coupling. These tuned magnetic fields generated by the primary coil can be arranged to interact vigorously with matched secondary windings in distant equipment but are much more weakly with any surrounding objects or materials such as radio signals or biological tissue, akly with any surrounding objects or materials such as radio signals or biological tissue.
Resonant coupling may include near field resonant coupling, mid field resonant coupling, and far field resonant coupling. Near field resonant coupling may be described as a wireless magnetic coupling where transmitting and receiving coils are spaced apart at a distance of equal to or less than 5x the diameter of the coil. Near field coupling may be highly efficient and may not strongly dependent upon preset angle orientation of the two coupled coils. 

Mid field resonant coupling may be described as a wireless magnetic coupling where the distance between a transmitting and receiving coil is approximately 5x to 1,000x the diameter of the transmitting and receiving coil is approximately 5x to 1,000x the diameter of the coil. Mid field resonant coupling may be relatively dependent on the preset relative angular orientation of the two coupled coils. Mid-field wireless transfer of energy or electronic signals may be possible over a wide range of relative angular orientation (e.g., 40-70 degrees) and over distances of up to about 1-2 meters utilizing highly efficient magnetic resonance coupling between the receiver and the antenna with energy transfer efficiency of up to 80%. Far field resonant coupling may describe coupling where the distance between the transmitting and receiving coil is above 1,000x the diameter of the coil. Far field resonant coupling may be such that the angle orientation of the two coupled coils is not significantly important. Impedance matching of two coupled coils may be used.

High quality factor resonators enable efficient energy transfer at lower coupling rates at greater distances and with greater freedom of positioning. Highly resonant technique uses a magnetic field to transfer energy. This can also be referred to as using a magnetic field to transmit energy. This can also be referred to as magnetic resonance. Highly resonant wireless energy transfer or highly resonant magnetic resonance, highly resonant wireless energy transfer or highly resonant wireless energy transfer provides the ability to transfer energy (in the form of power) over a range of distances and various positional locations and orientations. By using highly resonant coupling as opposed to conventional inductive coupling, the location angle may be more forgiving. And by having multiple coils located either within the base unit or the electronic wearable device system, the efficiency of the wireless energy transfer may be further improved. The mobile base unit may transfer electromagnetic power adiabatically to an electronic circuit of the electronic wearable device through inductive coupling, resonant coupling of both.

Fig. 9 shows a block diagram of a system for wirelessly powering one or more electronic devices according to some examples of the present disclosure. The system includes a base unit 100 and one or more electronic devices 200. The base unit 100 includes a base unit 100 and one or more electronic devices 200. The base unit 100
is configured to wirelessly provide power to one or more of the electronic devices 200, which may be separated from the base unit 100 by a distance. The base unit 100 is configured to provide power wirelessly to an electronic device 200 while the electronic device remains within a threshold distance (e.g., a charging range or charging zone 109) of the base unit 100. The base unit 100 may be configured to selectively transmit power wirelessly to any number of electronic devices (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 power wirelessly to any number of electronic devices (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 announg a greater number than 10 devices may be charged in some examples) detected although a greater number than 10 devices may be charged in some examples) detected to be within a proximity (e.g., within the charging range) of the base unit 100. Although the electronic device 200 may typically be charged (e.g., coupled to the base unit for charging) while being distance-separated from the base unit 100, it is envisioned that within the scope of this disclosure that the base unit 100 may operate to provide power wirelessly to an electronic device 200 when the electronic device 200 is adjacent to or in contact with the base unit 100.

[052] The base unit 100 includes a transmitter 110, a battery 120, and a controller 130. The transmitter 110 includes at least one transmitting coil 112 (interchangeably referred to as TTx coil). The transmitting coil 112 may include a magnetic core with conductive windings. The windings may include copper wire (also referred to as copper windings). In some examples, the copper wire may be monolithic copper wire (e.g., single-strand wire). In some examples, the copper wire may be multi-strand copper wire (e.g., Litz wire), which may reduce resistivity due to skin effect in some examples, which may allow for higher transmit power because resistive losses may be lower. In some examples, the magnetic core may be a ferrite core (interchangeably referred to as ferrite rod). The ferrite core may comprise a medium permeability ferrite, referred to as ferrite rod. The ferrite core may comprise a high permeability ferrite, for example 78 material supplied by Fair-Rite Corporation. In some examples, the ferrite core may comprise a high permeability material, such as Vitroperm 500F supplied by Vacuumschmelze in Germany. Ferrite cores comprising other ferrite materials may be used. In some examples, the ferrite may have a medium permeability of micro-i (µ) of about 2300. In some examples, the ferrite may have permeability of micro-i (µ) ranging from 2000 to about 5000. Generally, transmitting coils described herein may utilize magnetic cores which may in some examples shape the field provided by the transmitting coil, as the field lines preferentially go through the field provided by the transmitting coil, as the field lines preferentially go through the...
magnetic core, in this manner, partially guided flux may be used where a portion of the magnetic core, in this manner, partially guided flux may be used where a portion of the flux is guided by the magnetic core.

210. The transmitting coil 112 is configured to inductively couple to a receiving coil 210 in the electronic device 200. In some examples, the transmitting/receiver may be referred to herein as a sphere, it will be understood that the three dimensional (3D) space corresponding to the sphere, it will be understood that the three dimensional (3D) space corresponding to the inverse receiver may be referred to herein as a sphere, it will be understood that the three dimensional (3D) space corresponding to the inverse receiver may be referred to herein as a sphere. The transmitting coil of the transmitter/receiver may be configured as a receiving coil. For example, the transmitting coil of the transmitter/receiver may additionally be configured as a receiving coil. The transmitting coil of the transmitter/receiver may additionally be configured as a receiving coil. In some examples, the transmitting/receiver may additionally include a receiving coil. In yet further examples, the transmitting/receiver may additionally include a receiving coil. In yet further examples, the base unit may include a separate receiving coil 140 comprising a receiving coil. The transmitter/receiver or separate receiver of the base unit may be configured to wirelessly receive power (102) and/or data (104) as will be further described below.

In some examples, the transmitter 110 may include a single transmitting coil 112. The transmitting coil 112 may be placed in an optimal location and/or orientation to provide an optimum charging zone 106. In some examples, the transmitting coil may be placed in a location within the base unit selected to provide a large number of charging opportunities during a typical use of the device. For example, the transmitting coil 112 may be placed near a side of the base unit which most frequently comes in proximity to an electronic device.

The transmitting coils 112 may be arranged in virtually any pattern. For example, the base unit may include a pair of coils which are arranged to one another. In some examples, the coils may be arranged at angles smaller than 90 degrees, for example 45 degrees, for example ranging between 15-75 degrees. In some examples, the coils may be arranged at 45 degrees to one another. Other combinations and arrangements may be used, examples of which will be further described below.

In some examples, the transmitting coils may be arranged to provide a nearly omnidirectional charging zone 106 (also referred to as charging sphere or hotspot). The charging zone 106 of the base unit may be defined by a three dimensional space around the base unit which extends to a defined distance from the base unit in all three directions (e.g., the x, y, and z directions). Although the three dimensional (3D) space corresponding to the charging zone of the base unit may be referred to herein as a sphere, it will be understood that the three dimensional (3D) space corresponding to a sphere, it will be understood that the three dimensional (3D) space corresponding to a sphere, it will be understood that the three dimensional (3D) space corresponding to a
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Efficiency of wireless power transfer within the charging zone 106 may be variable, for example, depending on a particular combination of transmitting and receiving coils and/or a particular arrangement of the coils relative arrangements of the coils in the base unit and electronic device(s). The one or more transmitting coils 112 may be arranged within a housing of the base unit in a manner which improves the efficiency of power transmission within the zone 106. In some examples, one or more transmitting coils 112 may be arranged within the housing of the base unit in a manner which increases the opportunities for charging during typical use of the base unit. For example, the transmitting coil(s) may extend, at least partially, along one or more sides of the base unit which are most brought near an electronic device (e.g., the top or sides of a mobile phone case) base unit which frequently be moved in proximity with a wearable electronic device such as eyewear or a digital wrist watch). In some examples, the base unit may be placed on a surface (e.g., a table or desk) during typical use and electronic devices may be placed around the base unit. In some examples, the base unit may be worn on a duty belt and charge devices arrayed alongside the base unit on the belt. In such examples, the transmitting coil(s) may be arranged along a perimeter of the base unit or on a surface of the base unit housing. In other examples the base unit may be integrated with or attached to a holster. In some examples, the transmitting coil(s) may be arranged along a back side of the base unit. In some examples, the transmitting coil(s) may be arranged along a back side of the base unit.
having a shape corresponding to the article to which it is intended to be attached. An
attachment mechanism may be coupled to the housing such that the base unit may be
removably attached to the article to which it is intended to be attached. In an example, the attachment mechanism may be
removably attached to an article or device. In an example, the attachment mechanism
may be a biasing member, such as a clip, which is configured to bias the article or
device towards the base unit in the form of, by way of example only, a rectangular
device towards the base unit in the form of, by way of example only, a rectangular
plate. For example, a clip may be provided proximate a side of the base unit and the
plate. For example, a clip may be provided proximate a side of the base unit and the
base unit may be attached to (e.g., clipped to) a mobile phone via the clip in a manner
base unit may be attached to (e.g., clipped to) a mobile phone via the clip in a manner
similar to attaching paper or a notebook/notepad to a clip board. In some examples, the
similar to attaching paper or a notebook/notepad to a clip board. In some examples, the
base unit may be adhesively or elastically attached to the article or device.

In further examples, the base unit may be separate from the article or device. In
yet further examples, the base unit may be incorporated into (e.g., integrated into) the
article or device. For example, the transmitter 110 may be integrated with other
components of a typical mobile phone, radio, walkie-talkie, or other device. In another
example, the transmitter 110 may be integrated into a brim of a hat or other article. The
controller 130 may be a separate IC in a device or its functionality may be incorporated
into the processor and/or other circuitry of the device. Typical mobile phones,
flashlights, radios, and walkie-talkies include a battery (e.g., a rechargeable battery)
which may also function as the battery 120 of the base unit. In this manner, an article
or device may be configured to provide power wirelessly to electronic devices, such as
devices, such as

As previously noted, the base unit 100 may include a battery 120. The battery
120 may be a rechargeable battery, such as a Nickel-Metal Hydride (NiMH), a Lithium
120 may be a rechargeable battery, such as a Nickel-Metal Hydride (NiMH), a Lithium
ion (Li-ion), or a Lithium ion polymer (Li-ion polymer) battery. The battery 120 may
ion (Li-ion), or a Lithium ion polymer (Li-ion polymer) battery. The battery 120 may
be coupled to other components to receive power. In an example, the battery 120 may
be charged by a security vehicle. In another example, the battery 120 may be charged
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coupled to an energy generator 150. The energy generator 150 may include an energy
generator 150. The energy generator 150 may include an energy
generator 150. The energy generator 150 may include an energy
genrating device which may provide harvested energy to the battery for storage and
use in charging the electronic device(s). Energy harvesting devices may include, but
not be limited to, kinetic-energy harvesting devices, solar cells, thermoelectric
generators, radio-frequency harvesting devices, etc. In some examples, the battery 120
may be coupled to an input/output connector 180, such as a universal serial bus (USB)
port, etc. It will be understood that the term USB port herein includes any type of USB
port. It will be understood that the term USB port herein includes any type of USB
port. It will be understood that the term USB port herein includes any type of USB
interface currently known or later developed, for example mini and micro USB type interfaces. Other types of connectors currently known or later developed, may additionally or alternatively be used. The I/O connector 180 (e.g., USB port) may be used to couple the base unit 100 to an external device, for example an external power source or a computing device (e.g., a computer, laptop, tablet, or a mobile phone). The base unit 100 may also act as an auxiliary battery pack for one or more devices. In an example, the base unit 100 does not comprise a battery or does not comprise a battery as a primary power source. In an example, the battery 120 may be remote from the base unit (e.g., outside of a housing of the base unit). In an example, the base unit 100 comprises a port configured to receive power from a power source.

The transmitter 110 is operatively coupled to the battery 120 to selectively receive power from the battery and wirelessly transmit the power to the electronic device 200. As described herein, in some examples, the transmitter may combine the functionality of transmitter and receiver. In such examples, the transmitter may also be configured to wirelessly receive power from an external power source. It will be understood that during transmission, power may be wirelessly broadcast by the transmitter and may be received by any receiving devices within proximity (e.g., within the broadcast distance of the transmitter).

The transmitter 110 may be tightly- or weakly-coupled to a receiver in the electronic device 200, in some examples. Depending on the distance between the transmitter 110 and the electronic device 200, there may or may not be a tight coupling between the transmitter 110 and the receiver in the electronic device 200. Highly resonant coupling may be considered tight coupling. The weak (or loose) coupling may allow for power transmission over a distance (e.g., from a base unit on a duty belt to a wearable device placed on the surface in a neighborhood of, but not on, the base unit). So, for example, the transmitter 110 may be distance separated from the receiver. The distance may be less than 1 mm in some examples, greater than 1 mm in some examples, greater than 200 mm in some examples, and greater than 1000 mm in some examples. Other distances may be used in other examples, and power may be transferred over these distances. The transmitter in other examples, and power may be transferred over these distances.
110 and the receiver in the electronic device 200 may be, at times, weakly coupled and, at other times, may be strongly coupled. The transmitter 110 and the receiver in the electronic device 200 may include impedance matching circuits each having an inductance, capacitance, and resistance. The impedance matching circuits may function to adjust impedance of the transmitter 110 to better match impedance of a receiver under normal expected loads, although in examples described herein the transmitter and receiver may have transmit and receive examples described herein the transmitter and receiver may have transmit and receive costs, respectively, with different sizes and/or other characteristics such that the impedance of the receiver and transmitter may not be matched by the impedance matching of the transmitter and receiver. The transmitter 110 may generally provide a wireless power signal which may be provided at a body-safe frequency, e.g., less than 500 kHz in some examples, less than 300 kHz in some examples, less than 200 kHz in some examples, between 75 kHz and 175 kHz in some examples, 175 kHz in some examples, less than 100 kHz in some examples, although other frequencies may be used. In some examples, the frequency may be within the range of 100 kHz and 1 GHz, 1 kHz and 1 GHz, and 100 kHz and 10 GHz. In another example, the frequency may be within the range of 1 MHz and 1 GHz. In another example, the frequency modulation may be 13.56 MHz +/- 5%.

Transmission/broadcasting of power may be selective in that a controller controls when power is being broadcast. The base unit may include a controller 130 coupled to the battery 120 and transmitter 110. The controller 130 may be configured to switch to the battery 120 and transmitter 110. The controller 150 may be configured to cause the transmitter 110 to selectively transmit power, as will be further described. The controller 150 may be configured to cause the transmitter 110 to selectively transmit power, as will be further described. A charger circuit may be connected to the battery 120 to protect the battery from overcharging. The charger circuit may monitor a level of charge in the battery 120 and turn off charging when it detects that the battery 120 is fully charged. The functionality of the charger circuit may, in some examples, be incorporated within the controller 130 or it may be a separate circuit (e.g., separate IC chip). In some examples, the base unit may include a memory 160. The memory 160 may be coupled to the transmitter 110 and/or any additional transmitters and/or receivers (e.g., receivers 140) for storage of data transmitted to and from the base unit 100. For example, the base unit 100 may be configured to communicate data wirelessly 100.
to and from the electronic device 200. For example, the base unit may receive images, audio, and/or video acquired with an electronic device, and/or transmit configuration data to the electronic device. The base unit may include one or more sensors 170, which may be operatively coupled to the controller. A sensor 170 may detect a status of the base unit such that the transmitter may provide power selectively and/or virtually out of the base unit, such as an external temperature, a heart rate of a user, and/or outside of the base unit, such as an external temperature, a heart rate of a user, and/or other statuses or states. In some examples, the base unit may further comprise a microphone, an audio recorder, an audio playback unit, a microphone, an audio recorder, an audio playback unit.

The electronic device 200 may be configured to provide virtually any functionality, for example an electronic device configured as a wearable camera, an electronic watch, an electronic band, and other such smart devices. In addition to circuitry adapted to perform the specific function of the electronic device, the electronic device 200 may further include circuitry associated with wireless charging. The electronic device 200 may include at least one receiving coil 212, which may be coupled to a rechargeable power cell onboard the electronic device 200. Frequent charging in a manner that is non-invasive or minimally invasive to the user during typical use of the electronic device may be achieved via wireless coupling between the receiving and transmitting coils in accordance with the examples herein.

In some examples, the electronic device may be a wearable electronic device, which may interchangeably be referred to herein as electronic wearable devices. The electronic device may have a sufficiently small form factor to make it easily portable by a user. The electronic device 200 may be attachable to clothing, an accessory worn by a user. The electronic device 200 may be attachable to clothing, an accessory worn by the user (e.g., eyewear or headgear), or an article or device carried by the user (e.g., a fire arm or a flashlight). For example, the electronic device 200 may be attached to eyewear using a guide 6 (e.g., track) incorporated in the eyewear. In some examples, the electronic device 200 may be a miniaturized camera system which may, in some examples, be attached to a firearm. In other examples, the electronic device may be any other type of an electronic device, such as an image display system, an air quality sensor, a UV/HEV sensor, a pedometer, a night light, a blue-tooth enabled communication device such as a blue-tooth headset, a hearing aid or an audio system. In some examples, the electronic device may be worn on the body, for example around the
wrist (e.g., an electronic watch or a biometric device, such as a pedometer). The
wrist (e.g., an electronic watch or a biometric device, such as a pedometer). The
electronic device 200 may be another type of electronic device other than the specific
electronic device 200 may be another type of electronic device other than the specific
examples illustrated. The electronic device 200 may be virtually any miniaturized
electronic device, for example and without limitation a camera, image capture device,
electronic device, for example and without limitation a camera, image capture device,
IR camera, still camera, video camera, image sensor, repeater, resonator, sensor, sound
amplifier, directional microphone, eyewear supporting an electronic component,
amplifier, directional microphone, eyewear supporting an electronic component,
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visible light sensor, visible light sensor, visible light sensor, visible light sensor,
acoustic sensor, range finder, laser system, topography sensor, motor, micro motor, nano motor, switch, battery, dynamo, thermal power source, fuel cell, solar cell, kinetic energy source, thermo electric power source, smart band, smart watch, smart earring, smart necklace, smart clothing, smart ring, smart bra, smart shoes, smart footwear, smart gloves, smart hat, smart headwear, smart eyewear, and other such smart devices. In some examples, one or more of the listed components may be integrated into the base unit. In some examples, the electronic device 200 may be expanded to include a wearable electronic device or an implanted device.

The electronic device 200 may include a receiver (e.g., Rx coil 212) configured to inductively couple to the transmitter (e.g., Tx coil 112) of the base unit 100. The receiver may be configured to automatically receive power from the base unit when the electronic device is within proximity of the base unit (e.g., when the electronic device is at a predetermined distance or within a charging range from the base unit). The electronic device 200 may store excess power in a power cell on board the electronic device. The power cell on board the electronic device may be significantly smaller than the battery of the base unit. Frequent recharging of the power cell may be effected by virtue of the electronic device frequently coming within proximity of the base unit during normal use. For example, in the case of a wearable electronic device coupled to eyewear and a base unit in the form of a cell phone case, the electronic device coupled to eyewear and a base unit in the form of a cell phone case, during normal use, the cell phone may be brought to proximity of the user's head to conduct phone calls during which times recharging of the power cell on board the wearable electronic device may be achieved. As another example, a firearm with a wearable electronic device may be achieved. As another example, a firearm with a mounted electronic device may, during normal use, be located in a holster, which may include a base unit for wirelessly recharging an electronic device of the firearm. In some examples, in which the wearable electronic device comprises an electronic watch or biometric sensor coupled to a wrist band or an arm band, the wearable electronic device may be frequently recharged by virtue of the user reaching for their cell phone and the base unit in the form of a cell phone case coming within proximity to the wearable electronic device. In some examples, the electronic device may include an energy harvesting system. In some examples, the electronic device may include an energy harvesting system.
In some examples, the electronic device 200 may not include a battery and may instead be directly powered by wireless power received from the base unit 100. In some examples, the electronic device 200 may include a capacitor (e.g., a supercapacitor or an ultracapacitor) operatively coupled to the Rx coil 212.

Typically in existing systems which apply wireless power transfer, transmitting and receiving coils may have the same or substantially the same coil ratios. However, given the smaller form factor of miniaturized electronic devices according to the present disclosure, such implementation may not be practical. In some examples, the receiving coil may be significantly smaller than the transmitting coils, e.g., as illustrated in FIG. 2. In some examples, the Tx coil 112 may have a dimension in a respective dimension of the Rx coil 212 (e.g., a surface area of the core 117 which is greater, for example, twice or more, than a respective dimension of the Rx coil 212) and a number of windings 116, a diameter of the wire forming the windings 116, a diameter of the coil 112, a number of windings 116, a length of the coil 112, a diameter of the core 117, a surface area of the core 117 which is greater, for example, twice or more, than a respective dimension of the Rx coil 212 (e.g., a surface area of the core 217 which is greater, for example, twice or more, than a respective dimension of the Rx coil 212). In some examples, a dimension of the Tx coil 112 may be, for example, two times or greater, five times or greater, ten times or greater, twenty times or greater, or fifty times or greater, than a respective dimension of the Rx coil 212. In some examples, a dimension of the Tx coil 112 may be, for example, up to 100 times a respective dimension of the Rx coil 212. For example, the receiving coil 212 (Rx coil) may comprise conductive wire having wire diameter of about 0.2 mm. The wire may be a single strand wire. The Rx coil in this example may have a diameter of about 2.4 mm and a length of about 13 mm. The Rx coil may include a ferrite rod having a diameter of about 1.5 mm and a length of about 15 mm. In an example, the length of a transmitting coil 112 (Tx coil) can be longer than the receiving coil 212 (Rx coil). In another example, the transmitting coil 112 (Tx coil) and the receiving coil 212 (Rx coil) may have substantially the same length, number of windings, and thickness. The number of windings in the Rx coil may be, by way of example only, approximately 130. The transmitting coil 112 (Tx coil) may comprise a conductive wire having a wire diameter of about 0.2 mm. The Tx coil in this example may have a diameter

The wire may be a multi-strand wire. The Tx coil in this example may have a diameter...
of about 14.5 mm and a length of about 67 mm. The Tx coil may include a ferrite rod having a diameter of about 8 mm and a length of about 67 mm. Approximately 74 windings may be used for the Tx coil. Other combinations may be used for the Tx coil. In some examples, the Tx coil may include a larger number of windings and/or a greater length of wire in the Rx coil in other examples, e.g., to optimize power transfer efficiency even at distances in excess of approximately 30 cm or more. In some examples, the transfer distance may exceed 12 inches. In some examples herein, the Tx and Rx coils may not be matched, as may be typical in conventional wireless power transfer systems. Thus, in some examples, the Tx and Rx coils of the base unit and electronic device, respectively, may be referred to as being loosely-coupled. According to some examples, the base unit is configured for low Q factor wireless power transfer. For example, the base unit may be configured for wireless power transfer at Q factors less than 100, less than 250 in some examples, less than 500 in some examples, less than 100 in some examples, less than 300 in some examples, less than 60 in some examples, and other Q factors may be used. While impedance matching is not required, examples in which the coils are at least partially impedance matched are also envisioned and within the scope of this disclosure. While the Tx and Rx coils in wireless power transfer systems described herein may be typically loosely coupled, the present disclosure does not exclude examples in which the Tx and Rx coils are impedance matched.

[071] The receiving coil (e.g., Rx coil 212) may include conductive windings, for example copper windings. Conductive materials other than copper may be used. In some examples, the windings may include monolithic (e.g., single-strand) or multi-strand wire. In some examples, the length of the metal that makes up the coil can range between 1 cm and 0.3 cm. In some examples, the coil can be in the form of a rectangle, oval, circle, square, and/or any other shape. In some examples, the core may be a magnetic core which includes a magnetic material such as ferrite. The core may be shaped as a rod. The Rx coil may have a dimension that is smaller than a dimension of the Tx coil, for example a diameter, a length, a surface area, and/or a mass of the core (e.g., rod) of the Tx coil. In some examples, the magnetic core (e.g., ferrite rod) of the Tx coil may have a surface area that is two greater or more than a surface area of the magnetic core (e.g., ferrite rod) of the Rx coil. In some examples, the Rx coil may include a larger number of windings and/or a greater length of wire in the
windings when unwound than the number or length of wire of the windings of the Rx coil. In some examples, the length of unwound wire of the Tx coil may be at least two times the length of unwound wire of the Rx coil. A diameter φ of the Tx coils may range from about 5 mm to about 20 mm. In some examples, the diameter φ of the Tx coils may range from 5 mm to 15 mm. In some examples, the diameter φ of the Tx coils may be between 8 mm and 10 mm. In some examples, the diameter φ of the Tx coils may be 9 mm, 10 mm, 11 mm, 12 mm, 13 mm, or 14 mm. Different diameters for the coils may be used. The magnetic cores of the coils may be used. The magnetic cores in this example are implemented as elongate cylindrical rods made from a magnetic material. The rods in this example are arranged around the perimeter of the base unit. The rods in this example are arranged around the perimeter of the base unit. In some examples, the rods may extend substantially along the full length of the 1100. In some examples, the rods may extend substantially along the full length of the 10 side, bottom side, left and right sides of a housing of the base unit.

In some examples, an Rx coil 212 may have a length from about 1.0 mm to about 150 mm and a radius from about 1 mm to about 15 mm. In other examples, the performance of an Rx coil 212 having a ferrite rod 20 mm in length and 2.5 mm in diameter with 150 Conductive windings wound thereupon was simulated with a Tx coil 112 configured to broadcast power at a frequency of about 725 kHz. The Tx coil 112 included 24 ferrite rods having a length of approximately 67.5 mm and a diameter of approximately 1/2 mm. The performance of the coils was simulated in an aligned orientation in which the coils were coaxial and in a parallel orientation in which the coils were parallel to each other, and example results of simulations performed are shown in FIGS. 11 and 12. Up to 20% transmission efficiency was obtained in the aligned orientation at distances of up to 200 mm between the coils. Some improvement was observed in the performance when the coils were arranged in a parallel orientation, in which the Rx coil continued to receive transmitted power until a distance of about 300 mm. Examples of a wireless energy transfer system according to the present disclosure were compared with efficiency achievable by a system configured in accordance with the QC 1.0 standard. The size of the Tx coil in one simulated system was 52 mm x 52 mm x 3.6 mm and a size of one Rx coil simulated was 25 mm x 25 mm x 15 mm and load impedance was 10 KΩ. Simulations were performed in 48 aligned configurations with several Rx coil sizes, and example results of simulations performed are shown in FIG. 13. Example Rx coil sizes, and example results of simulations performed are shown in FIG. 13.
[074] Referring now also to FIG. 3, an example base unit 300 will be described. The base unit 300 may include some or all of the components of base unit 100 described above with reference to FIG. 1. For example, the base unit 300 may include a transmitting coil 312 (also referred to as Tx coil). The transmitting coil 312 is coupled to an electronics package 305, which includes circuitry configured to perform the functions of a base unit in accordance with the present disclosure, including selectively and/or adjustably providing wireless power to one or more electronic devices. In some examples, the electronic device may be an electronic device which is separated from the base unit, the electronic device may be an electronic device which is separated from the base unit.

[075] The base unit 300 may provide a mobile wireless hotspot (e.g., charging sphere) for wirelessly charging electronic devices that are placed or come into proximity of the base unit (e.g., within the charging sphere). In an example, the base unit 300 may be implemented in the form of a firearm holster that may be worn on a duty belt of a user, thus making the hotspot of wireless power mobile and available to electronic devices carried by the user. As will be further appreciated, opportunities for recharging the power cell on an electronic device worn by the user are frequent during normal wearing of a duty belt, which may carry a number of electronic devices for the wearer, including a cell phone, radio, walkie-talkie, flashlight, and other devices.

[076] In examples, the base unit 300 may be integrated with or carried on a security or law enforcement officer’s duty belt. The hotspot of wireless power by virtue of being connected to the user’s duty belt, which the officer often or always carries with him or her, thus advantageously travels with the user. In another example, the base unit 300 may be implemented in the form of a mobile phone case that may be attached to or may be implemented in the form of a mobile phone case that may be attached to a mobile phone and carried by the user, thus making the hotspot of wireless power mobile and available to electronic devices wherever the user goes. In examples, the mobile is available to electronic devices wherever the user goes. In examples, the base unit 300 may be integrated with a mobile phone. As will be further appreciated, opportunities for recharging the power cell on an electronic device worn by the user are frequent during the normal use of the mobile phone, which by virtue of being use may frequently be brought into the vicinity of wearable devices (e.g., eyewear devices when the user is making phone calls, wrist worn devices when the user is browsing or using other function of the mobile phone), and worn devices when the user is browsing or using other function of the mobile phone).
The Tx coil 312 and electronics (e.g., electronics package 305) may be enclosed in a housing 315. The housing 315 may have a portable form factor. In this example, the housing is implemented in the form of an attachment member configured to be attached to a device or article. In some examples, the device may be a mobile communication device, such as a mobile phone, a cellular phone, a smart phone, a two-way radio, a tablet, a walkie-talkie, and the like. In further examples, the housing of the base unit may be implemented as an attachment member adapted to be attached to the base unit may be implemented as an attachment member adapted to be attached to or integrated into an article, such as a belt, strap, holster, headgear, headwear, eyewear, clothing, smart clothing or others. The housing 315 may include features for clothing, smart clothing or others. The housing 315 may include features for mechanically engaging the device or article, length (l), width (w), and thickness (t) of the housing 315 may range from about 150-180 mm, 80-95 mm, and 15-25 mm, respectively. Other lengths, widths, and thicknesses may be used, e.g., to accommodate a given article or device and/or accommodate a particular coil size. In further examples, the housing may be configured to provide or contribute to one or more of: water resistance, moisture resistance, sweat resistance, dust resistance, shock resistance, drop resistance, water-proofing and/or other characteristics of the base unit.

In example in FIG. 2, the base unit 300 includes a transmitting coil 312. The transmitting coil 312 may include a magnetic core with conductive windings. The core may be made of a ferromagnetic material (e.g., ferrite), a magnetic metal, or alloys or combinations thereof, collectively referred to herein as magnetic material. For example, a magnetic material such as ferrite and various alloys of iron and nickel may be used. The coil 312 includes conductive windings 316 provided around the core. It will be understood in the context of this disclosure that the windings may be, but need not be, provided directly on the core. In other words, the windings may be spaced from the core material which may be placed within a space defined by the windings, as will be described with reference to FIGS. 7-8. In some examples, improved performance may be achieved by the windings being wound directly onto the core as in the present example, or by the windings being wound directly onto the core as in the present example.

The core may be shaped as an elongate member and may have virtually any cross section. For example, a rectangular or circular cross section. The term rod may interchangeably be referred to as a rod, e.g., a cylindrical rod or rectangular rod. The term rod may be used to refer to an elongate core in accordance with the present application,
regardless of the particular cross sectional shape of the core. The core may include a single rod or any number of discrete rods (e.g., 2, 4, 6, 7, 18, 40, or any other number greater than 10) arranged in patterns as will be described. In the examples in FIGS. 4 and 5, without limitation, the transmitting coil comprises a single cylindrical rod positioned at least partially along a top side (e.g., top side) or the housing 315, or a rod positioned at least partially along a first side (e.g., top side) of the housing 315. In other examples, one or more coils may alternatively or additionally be positioned along other sides, e.g., a bottom side, a left side and/or a right side of the housing 315.

[080] The electronics package 305 (interchangeably referred to as electronics or circuitry) may be embedded in the housing 315 or provided behind a cover, which may be removable. In some examples, it may be advantageous to replace the battery 320 be removable. In some examples, it may be advantageous to replace the battery 320.

[081] The base unit may be provided with one or more I/O devices 380. I/O devices may be used to receive and/or transmit power and/or data via a wired connection between the base unit and another device. For example, the base unit may include an I/O device 380 in the form of a USB connector. The I/O device 380 may include a first connection side (e.g., a female port) for coupling the base unit to external devices (e.g., a power source such as the power grid and/or another base unit) or external devices (e.g., a power source such as the power grid and/or another electronic device). The I/O device 380 may include a second connection side (e.g., a male connector) for coupling the base unit to external devices (e.g., a mobile phone, a portable hard drive, a memory card, and/or another electronic device).

[082] The base unit 300 may include a controller 330. The controller may include functionality for controlling operations of the base unit, for example, controlling detection of electronic devices within proximity, selective transmission of wireless power, upon detection of an electronic device, determination of status of the base unit, and selection of transmission mode depending on the status of the base unit. These functions may be implemented in computer readable media or hardwired into ASICs or functions may be implemented in computer readable media or hardwired into ASICs or
other processing hardware. The controller may interchangeably be referred to as base
other processing hardware. The controller may interchangeably be referred to as base

The base unit may include one or more memory devices 360. The base unit
may include volatile memory 352 (e.g., RAM) and non-volatile memory 364 (e.g.,
EEPROM, flash or other persistent electronic storage). The base unit may be
configured to receive data (e.g., user data, configuration data, video data, image
data, audio data, sensor data) through wired or wireless connection with external
electronic devices and may store the data on board the base unit (e.g., in one or more of
the memory devices 360). The base unit may be configured to transmit data stored
to another party (e.g., to a remote backup site or a reviewer). In another example, the base unit may relay received data to another party
without storing the data onboard the base unit. In addition to user data, the
memory devices may store executable instructions which when executed by a
processor (e.g., processor 330), cause the base unit to perform functions described
herein.

The base unit 300 may include a charger circuit 332, which may be configured
to protect the battery 320 from overcharging. The charger circuit may be a separate
chip or may be integrated within the controller 330. The base unit may include a
separate transmitter/receiver circuitry 340 in addition to the Tx coil 312 used for
distance transmitter/receiver circuit 340 in addition to the tx coil 312 used for
wireless power transmission. The transmitter/receiver circuitry 340 may include a
receive/transmitting coil 342, e.g., an RF coil. The transmitter/receiver circuitry 340
may further include driver circuitry 344 for transmission (e.g., RF driver circuit) and
may further include driver circuitry 344 for transmission (e.g., RF driver circuit) and
for reception of signals (e.g., RF sensing circuit). The base unit 300
may include additional circuitry for wireless communication (e.g., Bluetooth, Wi-Fi, cellular, LTE, and/or other wireless communication. In some
examples, a coil of the base unit 300 (e.g., coil 312 or 342) may function as an antenna
or as a receiver. In some examples, the base unit 300 may include one or more
energy generator 330, as described herein. In addition, circuitry providing additional functionality may be included. For example, the base unit 300
may include an image, video, and/or audio processor for processing and/or
enhancement of images, video, and/or audio received from a wearable or mountable camera or microphone. In an example, image processing functionality may be provided in a separate integrated circuit (e.g., a DaVinci chip set by Texas Instruments) or it may be incorporated in a processor which implements the functions of controller 330.

In some examples, the housing 315 may be configured to receive or be coupled to a device or article. For example, a housing may be configured to provide the functionality of a firearm holster and may be configured to receive a firearm. For example, the housing may have an opening into which a firearm may be received. The housing may include engagement features for securing the firearm. One or more coils of the base unit may be placed along a length of the holster and/or around the perimeter of the base unit may be placed along a length of the holster and/or around the perimeter of the holster, e.g., along any of the top, bottom, or sides. In some examples, the housing 315 may be configured to be mechanically coupled to an article of clothing, such as a duty belt. In other examples, the housing 315 may be configured to receive a flashlight, baton, chemical spray, or other device or article.

With reference now also to FIGS. 4 and 5, operations of the base unit as per the drawings herein will be described. FIG. 4 illustrates, in process 400, the concept of wirelessly charging an electronic device 200 which is separate from (e.g., not attached to) the base unit (e.g., base unit 100 or 300). The base unit and/or the electronic device 200 may be moved to a position, such that the base unit and electronic device 200 are proximate to each other, as shown in block 420. For example, a user may wear or carry both the base unit 100 and the electronic device 200. During this time, the electronic device 200 may be in proximity to the base unit (e.g., within the charging range of the base unit) and may wirelessly receive power from the base unit.

The base unit may be configured to selectively transmit power. For example, the base unit may be configured to preserve energy during times when electronic devices are not sufficiently close to the base unit to receive the power signals. The base unit may be configured to stop transmission of power when no compatible electronic devices are detected in proximity. The base unit may be configured to start and/or stop transmission of power when a compatible electronic device is detected. The base unit may be configured to alert the user when an electronic device is outside of a particular range. The base unit may detect an electronic device in proximity, e.g., as shown in block 430. The electronic device may be in
proximity for charging while remaining separated by a distance from the base unit.

That is, electronic device may be in proximity for charging even though the
electronic device does not contact the base unit. In some examples, the electronic
device may broadcast a signal (block 410), which may be received by the base unit.

The signal may be a proximity signal indicating the presence of the electronic device.
The signal may be a charge status signal, which provides also an indication of the
The signal may be a charge status signal, which provides also an indication of the

charge level of a power cell (if any) within the electronic device. When the electronic
device is within a communication range of the base unit, the base unit may detect the

signal broadcast by the electronic device and may initiate power transfer in response to
signal broadcast by the electronic device and may initiate power transfer in response to
said signal. The communication range may be substantially the same as the charging
said signal. The communication range may be substantially the same as the charging

range. In some examples, the communication range may be smaller than the charging
range. In some examples, the communication range may be smaller than the charging
range. In some examples, the communication range may be smaller than the charging

range. In some examples, the communication range may be smaller than the charging

range. In some examples, the communication range may be smaller than the charging

[089] In some examples, broadcasting a signal from the electronic device may be
impractical, e.g., if limited power is available onboard the electronic device. The base
unit may instead transmit an interrogation signal. The interrogation signal may be
transmitted continuously or periodically. The electronic device may be configured to
send a signal (e.g., proximity signal, charge status signal, charging parameters such as
send a signal (e.g., proximity signal, charge status signal, charging parameters such as

but not limited to, charging frequency, power requirement, and/or coil orientation)
but not limited to, charging frequency, power requirement, and/or coil orientation)

responsive to the interrogation signal. In some examples, redundant detection
responsive to the interrogation signal. In some examples, redundant detection

functionality may be included such that both the base unit and the electronic device
functionality may be included such that both the base unit and the electronic device

functionality may be included such that both the base unit and the electronic device
functionality may be included such that both the base unit and the electronic device

functionality may be included such that both the base unit and the electronic device

functionality may be included such that both the base unit and the electronic device

[090] The base unit may wirelessly transmit power to the electronic device 200 (block
[090] The base unit may wirelessly transmit power to the electronic device 200 (block

440) while one or more conditions remain true. For example, the base unit may
440) while one or more conditions remain true. For example, the base unit may
continue to transmit power to the electronic device while the electronic device
continue to transmit power to the electronic device while the electronic device

within the charging zone of the base unit or until the power cell of the electronic device

is fully charged. With regards to the latter, the electronic device may transmit a charge
is fully charged. With regards to the latter, the electronic device may transmit a charge

status signal when the power cell is fully charged and the base unit may terminate
status signal when the power cell is fully charged and the base unit may terminate

broadcast of power signals when the fully charged status signal is detected. In some
broadcast of power signals when the fully charged status signal is detected. In some
examples, alternatively or in addition to sending a fully charged status signal, the electronic device may include a charging circuit which is configured to protect the power cell of the electronic device from overheating when charging stops. In this manner, an individual electronic device may stop receiving power while the base unit continues to transmit, e.g., in the event that multiple devices are being charged.

In some examples, the base unit may be configured to periodically or continuously send interrogation signals while broadcasting power signals. The interrogation signals may trigger response signals from electronic devices 200 in proximity. The response signals may be indicative of whether any electronic devices are in proximity and/or whether any devices in proximity require power. The base unit may be configured to broadcast power until no electronic devices are detected in proximity of the base unit.

In some examples, the base unit may be further configured to adjust a mode of power transmission. The base unit may be configured to transmit power in a low power mode, a high power mode, or combinations thereof. The low power mode may correspond to a power transfer mode in which power is broadcast at a first power level. The high power mode may correspond to a power transfer mode in which power is broadcast at a second power level higher than the first power level. The low power mode may correspond with a mode in which power is broadcast at a body-safe level. The base unit may be configured to detect a state of the base unit, as in block 450. For example, a sensor (e.g., an accelerometer, a gyroscope) onboard the base unit may detect a change in the position or orientation of the base unit, or a change in acceleration, which may indicate that the base unit is being held or moved towards the user's body. The controller may be configured to determine if the base unit is stationary (block 460) and change the power mode responsive to this determination. For example, if the base unit is determined to be stationary, the base unit may transmit power in the high power mode, as in block 470. If the base unit is determined not to be stationary, the base unit may reduce the power level of power signals transmitted by the base unit. The base unit may change the mode of power transmission to a lower power mode, as shown in block 480. The base unit may continue to monitor changes in the mode, as shown in block 480.
state of the base unit and may adjust the power levels accordingly, e.g., increasing power level again to high once the base unit is again determined to be stationary. The sensor may monitor the state of the base unit such that power transmission is optimized when possible while ensuring that power is transmitted at safe levels when appropriate (e.g., when the base unit is moving for example as a result of being carried or brought into proximity to the user's body). In some examples, a mobile phone may display an indication of a detected electronic device on the mobile phone.

In some examples, the base unit may be communicatively coupled to or incorporated into an electronic device, such as a mobile phone, walkie-talkie, two-way radio, or other electronic device. The electronic device may be configured to execute a software application, which may provide a user interface for controlling one or more software applications, which may provide a user interface for controlling one or more electronic devices. For example, the software application may enable a user to configure a power broadcast or interrogation signal to broadcast schedules and/or monitor the charge status of the base unit and/or electronic device coupled thereto. As another example, the software application may enable the user to change the state for determining when to wirelessly transmit power, begin recording, and/or taking other actions. In some examples, the functionality of the base unit may be controlled by another party, separate from the user of the base unit (e.g., remotely-located administrators). The software application may also enable processing of data received by the base unit from the electronic device(s), such as encryption, decryption, authentication, image processing, video processing, audio processing, adding metadata (e.g., date stamping, location stamping, watermarking, authenticating, etc.).

FIG. 5 illustrates a flow chart of a process 500 for wireless power transfer in accordance with further examples herein. In the example in FIG. 5, the base unit may be communicatively coupled to a device (e.g., a mobile phone, walkie-talkie, or two-way radio), such that the device may transmit a command signal to the base unit. The command signal may be a command to initiate broadcast of interrogation signals, as shown in block 505. The base unit may transmit an interrogation signal (block 510) responsive to the command signal. Proximity and/or charge status signals may be received from one or more electronic devices in proximity (block 515). Upon detection of an electronic device in proximity, the controller of the base unit may automatically control the transmitter to broadcast power signals (block 520). In some examples, an indication of a detected electronic device may be displayed on the mobile phone.
display. The device may transmit a command signal under the direction of a user, which may be a command to initiate power transfer. The base unit may continue to monitor the charge status of the electronic device (e.g., via broadcast of interrogation signals and receipt of responsive charge status signals form the electronic device), as shown in block 525. Broadcast of power from the base unit may be terminated upon the occurrence of an event, as shown in block 530. The event may correspond to receiving an indication of fully charged status from the one or more electronic devices being charged, receiving an indication of depleted stored power in the battery of the base unit, or a determination that no electronic device remain in proximity to the base unit, or a determination that no electronic device remain in proximity to the base unit. In some example, the broadcast of power may continue but at a reduced power level upon a determination that the base unit is in motion (e.g., being carried or moved by a user).

FIGS. 6A and 6B illustrate a base unit 600 having a housing 615 according to further examples herein. The housing 615 may be a partial case configured to attach to or receive a device or article 15. The device or article 15 may be a communication device (e.g., a cell phone, radio, walkie-talkie, or two-way radio), a firearm, a baton, handcuffs, a flashlight, a chemical spray device, or other device or article 15. The housing 615 may enclose the circuitry of the base unit 600. A movable cover 619 may be attached to the housing 615. The movable cover 619 may be hinged at one or more locations to allow the cover 619 to be moved out of the way to access the base unit 600. The movable cover 619 may be configured to allow the user to conveniently carry the base unit 600. For example, the movable cover 619 may be secured in a closed position via a conventional fastener (e.g., a snap, a magnetic closure, or other). In some embodiments, the fastener or other portion of the housing may be monitored by a sensor that determines whether the device or article 15 has been accessed or moved. In some examples, it may be desirable to maximize the number of windings or the length of wire used in the windings. A base unit having a generally flattened parallelepiped shape may have four perimeter sides (top, bottom, left and right sides)
and two major sides (front and back sides). The number of windings or length of wire used, in the windings may be maximized by placing the windings at the peripheral portion or the base unit. FIG. 7 illustrates examples of base units 700a-c in which the conductive windings 716 are provided at the perimeter of the base unit and the core material (e.g., core rods 714) is provided in an interior portion of the base unit spaced from the windings. Base unit 700a includes individual rods 714 which are arranged with their centerlines perpendicular to a major side (e.g., front or back side) of the base unit. Base units 700b and 700c include individual rods 714 which are arranged with their centerlines arranged parallel to a perimeter side of the base unit.

FIG. 8 illustrates arrangements of transmitting coils of base units according to further examples of the present disclosure. The conductive wire may be wound such that the wire is in a plane substantially parallel to a major side of the base unit. For example, base unit 800a includes a core material in the form of a core plate 817 and windings wrapped around the core plate with the coil axis substantially parallel to the left and right sides of the base unit. Base units 800b and 800c include windings 816 similar to the windings of base unit 800a but using discrete rods 816 as core material, the rods spaced inwardly from the windings and arranged parallel to a perimeter side of the base unit. Non-magnetic material may be provided in the spaces between the rods of the base unit. Non-magnetic material may be provided in the spaces between the rods in the examples in FIGS. 7 and 8. Different combination of orientations of the windings and rods than the specific examples illustrated may be used in other examples.

The base unit may be incorporated in a variety of shapes which may have a relatively small form factor. The base unit may be incorporated into a form factor which is portable, e.g., fits in a user's hand and/or easy to carry in the user's pocket, which is transportable, e.g., fits in a user's hand and/or may be transportable in a user's pocket or bag, or may be attachable to a wearable accessory of the user. For example, referring now also to FIG. 9 base unit 900 may have a housing 915 which has a generally cylindrical shape (e.g., puck shape). A base unit 900 may include some or all of the components of base units described herein and the description of such components will not be repeated. For example, the base unit may include a transmitter (e.g., Tx coil 912), a battery and a controller (not shown). The housing 915 may have a first major
side (e.g., a base) and a second major side (e.g., a top). The Tx coil may be placed along the perimeter (e.g., approximate and extending at least partially along the cylindrical perimeter side) of the base unit. In some examples, the core may be in the shape of a cylindrical core plate. The coil windings, cylindrical core plate, and cylindrical plate may be coaxially aligned. The base unit may include one or more cylindrical pucks that are coaxially aligned. The base unit 900 may include one or more input ports 960 for connecting the base unit to external power and/or another computing device. For example, the base unit 900 may include a first input port 960-1 for charging AC power thereto and a second input port 960-2 (e.g., USB port) for coupling the base unit to a computing device, e.g., a laptop or tablet. The base unit 900 may include one or more charge status indicators 990. The charge status indicator 990 may indicate one or more charge status indicators 990. The charge status indicators 990 may provide visual feedback regarding the status and/or charging cycle of the base unit, the electronic devices in proximity, or combinations thereof.

[099] An illumination device 992 may be provided around the perimeter of the base unit or the perimeter of a major side of the base unit. The illumination device may include a plurality of discrete light sources. Individual ones or groups of individual light sources may provide status indication for individual electronic devices, which may be inductively coupled to the base unit for charging. In some examples, an indicator display 994 may be provided on a major side (e.g., a top side) of the base unit. The indicator display may be configured to provide individual charge status indications for one or more electronic devices inductively coupled to the base unit for charging.

[100] The indicator display 994 may be configured to display other data. For example, the electronic device 200 may be configured as a camera and the indicator display 994 may display visual images or video received from a camera, such as live or stored images. In some examples, the indicator display 994 may be configured to store images. In some examples, the indicator display 994 may be configured to display data received from a sensor. In some examples, audio received from the camera may be played back using a speaker associated with the indicator display 994.

[101] FIG. 10 illustrates components of a transmitter and receiver circuits for a wireless Power system in accordance with the present disclosure. On the transmitter side of the system, the transmitting coil is represented by inductance L. The transmitter circuit is tuned to broadcast at desired frequency. To that end, the L11. The transmitter circuit is tuned to broadcast at desired frequency. To that end, the
transmitter circuit includes capacitor C1PAR and resistor R1PAR, which may be selected to tune the transmitter to the desired transmit resonance frequency. On the receiver side of the system, the receiving coil is represented by an inductance L1f, and the receiving coil is represented by an inductance L2f. Capacitor C2 and resistor R2 are chosen to tune the RLC circuit produced by the inductance of the receiving coil and C2 and R2 to the transmit resonance frequency produced by the transmitting coil. A rectifier (e.g., a full wave rectifier) is made from diodes D1, D2, D3, and D4. The rectifier in combination with the load circuit made up for RLoad, CLoad, and LLoad and convert the alternating signal induced in L2f to DC voltage output for charging the battery of the device. The load resistor RLoad to DC voltage output for charging the battery of the device. The load resistor RLoad and the load capacitor CLoad are selected to impedance match the diode bridge to the charging circuit for the battery used in the wearable device.

In some embodiments, the transmitting coil and thus the inductance L1f is relatively large compared to the inductance of the receiving coil and its inductance L2f. When transmitting and receiving coils are in close proximity the transfer efficiency is relatively high. At larger distances the efficiency is reduced but remains relatively high compared to other systems, such as a Qi standard compliant systems. This is illustrated in FIGS. 11-13.

In some examples, the shape of the pattern of a magnetic field between inductively coupled transmitting and receiving coils in accordance with the present disclosure may be largely omnidirectional with well-established nulls at the top and bottom of the coils. The radiation pattern can be directed by placing the coil against or near a reflecting ground plane to produce more of a unidirectional pattern.

FIG. 14 illustrates an example of magnetic field lines emanating from a transmitting coil and the field at the receiving coil when the position of the receiving coil is well known or predictable (e.g., in typical use scenarios). In such example, directed flux approach may be used to improve the efficiency of energy transfer.

A wireless camera system may be implemented in accordance with one or more of the embodiments described above. The system may be configured to capture visual data, audio data, geolocation data, date and time data and other data to capture visual data, audio data, geolocation data, date and time data and other data.

FIG. 15 illustrates an example wireless camera system 20, including a base unit 10000, a camera 10, and a sensor 170. The base unit 10000 may include some or all of the components and features of other base units described herein (e.g., base unit 100 of the components and features of other base units described herein (e.g., base unit 100...
or 300). The base unit 1000 may be configured to provide power to the camera 1100 or another electronic device. In an example, the base unit 1000 is configured to provide wireless power (e.g., to the camera 1100 or another electronic device) using the components and features described with regard to other units herein. In an example, the base unit 1000 is configured to provide power to the camera 1100 or another electronic device (e.g., using the components and features described with regard to other units herein). In an example, the base unit 1000 is configured to provide wireless power using any kind of inductive coupling. In an example, the camera 1100 and/or the sensor 1170 may be configured to operate as a stand-alone camera 1100 and/or the sensor 1170 may be configured to operate as a stand-alone components without a base unit. In an example, the system 20 may include more than one base unit and/or more than one camera. In an example, the system 20 includes a power source configured to provide power to the base unit 1000. The power source may be connected to the base unit 1000 using a wired or wireless connection. The power source may include or receive energy captured by an energy harvesting device.

The camera 1100 may include some or all of the components and features of electronic devices described herein (e.g., electronic device 200) and include the capability of taking or capturing an image, video, and/or audio. In an example, the camera 1100 may be a camera with a hemispherical lens configured with a 180 degree field of view. The camera 1100 may have an optic of a rounded half bubble, similar to a bulging fly eye having 180 micro-lenses mounted on it. The camera 1100 may have a hemispherical lens that is made up of a plurality of micro-lenses. The camera 1100 may have a half ball lens, a wide angle lens. In an example, the camera 1100 may include a CMOS APS chip. By way of example, the camera 1100 may be configured include a CMOS APS chip. In an example, the camera 1100 may be configured to record, omni-directional audio, bi-directional audio, directional audio, cardioid-pattern audio, and/or other kinds of audio.

The camera 1100 may be attached to various articles or devices, such as a belt, a firearm, a flashlight, a light, a band, a strap, an ear, a wire, or hat, a necklace, a watch, a bracelet, a headgear, and/or article of clothing, and/or other articles or devices. The camera 1100 can be supported by
eyewear. The camera 1100 can be embedded in or attached to a frame of the eyewear, a front of the eyewear, the temple of the eyewear, and/or an optic of the eyewear. The camera 1100 can be supported by the optic of the eyewear. In an example, the camera 1100 may be configured to send recorded data (e.g., images, audio, and/or

The camera 1100 may have a smaller form factor than conventional cameras by one or more of: reducing the size of a battery, eliminating the battery, eliminating a Bluetooth transceiver, reducing an amount of memory storage of the camera, eliminating a micro USB or other port, utilizing a camera on a chip (ASIC), utilizing a resonant capacitor, and/or adding a coil. The capacitor (which can be a super capacitor) can be powered wirelessly from a base unit by way of wireless energy transfer as needed while the camera 1100 is being used.

The camera 1100 may be configured to be powered remotely by the base unit 1000, receive data from the base unit 1000, and/or transmit data to the base unit 1000. The camera 1100 and base unit 1000 may comprise one or more resonance circuits for transmitting and receiving data. The camera 1100 may be configured to have a volume of less than 1,000 mm³ or less than 500 mm³ and configured to capture 1,000 images. The camera 1100 may be configured to capture 1 hour of more of video and/or audio. The camera 1100 may be configured to capture 1 hour of more of video and/or audio. The camera 1100 and base unit 1000 may be separated by 0.5 inches, 1 foot, 2 feet, 3 feet, 4 feet or greater. The camera 1100 can be located within or attached to an article feet, 4 feet or greater. The camera 1100 can be located within or attached to an article or a device. The base unit 1000 and camera 1100 may be configured to communicate or a device. The base unit 1000 and camera 1100 may be configured to communicate by way of wireless or direct connection. The communication can be that of wireless power or energy transfer. In an example, the camera 1100 may include on-board memory storage and may have less on-board memory storage capacity than that of the base unit 1000. In an example, the camera 1100 may include a battery and have less battery capacity than the base unit 1000.

The camera 1100 may be configured to wirelessly receive and/or transmit data. In an example, the camera 1100 may wirelessly receive instructions (e.g., start or stop recording), updates, or other data from the base unit 1000. In an example, the camera 1100 may be configured to send recorded data (e.g., images, audio, and/or
video) to the base unit 1000. The camera 1100 may utilize compression algorithms to reduce the size of data to be transferred. The camera 1100 may buffer data periodically (e.g., as needed) while collecting image, video, and/or audio data. For example, the camera 1100 may record data to a buffer and then transfer the data from the buffer to the base unit 1000. In an example, the camera 1100 does not include long-term storage for recorded data and instead uses temporary buffers, as needed, to accommodate for recorded data and instead uses temporary buffers, as needed, to facilitate the transfer of recorded data to the base unit.

The base unit 1000 may be configured to communicate with the camera 1100 using a very narrow communication protocol which allows power and data transfer over a greater distance. The base unit can also utilize a standard communication protocol for communicating with devices other than the camera 1100. The camera 1100 may be configured to utilize a very narrow communication protocol which allows for very power efficient wireless power and data transfer. The camera 1100 may be configured to use its own communication architecture and protocol that is unique for the camera 1100. In some examples, components of the system may communicate via RFLink. The base unit may utilize its own communication architecture and protocol which is unique for the base unit and the camera 1100 communicates with the base unit.

In certain embodiments, the architecture of the base unit and the camera 1100 could be a simplified version of standard architecture, such as Bluetooth and Wi-Fi. The camera 1100 may comprise an ASIC. The ASIC can utilize its own communication protocol that is unique for the ASIC. The camera 1100 can comprise at least one coil which can be separated by distance and resonant coupled to at least one coil of the base unit. A repeater can be utilized, if needed, in assisting communication between the two resonant coupled coils of the camera 1100. The resonant coupled coils of the two separated resonant coupled coils can have an efficiency below that of 80%, which may provide the appropriate wireless power transfer due to low power needs of the camera 1100. The distance between the two separated resonant coupled coils must be less than 1/6 inches, 6 inches, 1/2 inches, 2 inches, 1/36 inches, more than 1/36 inches or another distance, 6 inches of more, and the camera 1100 is configured to wirelessly transmit an image.
using 100 microwatts of power or less to the base unit 1000 and the base unit 1000, after factoring in the loss of efficiency, receives the image transmitted from the camera 1100. In an example, the camera 1100 is configured to transmit 10 watts or less of wireless power to the base camera and whereby the camera upon receiving the net wireless power from the base unit and after factoring in the loss of efficiency is capable of taking an image.

**[0114]** A camera module may provide functionality for the camera 1100. The camera module may comprise a switch, a power source, a sensor, memory, a controller, a module may comprise a switch, a power source, a sensor, memory, a controller, a microprocessor, a microphone, an audio processor, a video sensor, a video processor, a microphone, an audio processor, a video sensor, a video processor, an image sensor, an image processor, a micro-USB port and/or an LED. In certain arrangements the camera module can be integrated within the camera 1100. In other examples, the camera module is separate from but electrically connected to the camera 1100. The camera module can further comprise a coil (such as a tx coil [170] or a rx coil [212]). The camera module may include an energy harvesting device, such as a solar cell, to supplement the power received from the base unit.

**[0115]** The system 20 can comprise multiple cameras 1100. In an example, the multiple cameras may be arranged to provide a 360-degree view. For example, there may be three 120-degree field of view cameras, four 90 degree field of view cameras, five 72-degree field of view cameras, six 360-degree field of view cameras, or other types and arrangements of cameras. Multiple cameras can share or utilize common types and arrangements of cameras. Multiple cameras can share or utilize common coils, common memory storage, a common microphone, a common sensor, a common CPU, a common memory storage, a common sensor, a common ASIC, a common backup battery, a common base unit, or other resources. In an example, the plurality of cameras utilize a common coil that is resonant coupled to a coil of a remote base unit. In an example, each of the plurality of cameras can utilize a unique frequency or frequency modulation.

**[0116]** The sensor 1170 may include some or all of the components and features of an electronic device described herein (e.g., electronic device 200). The sensor 1170 may be configured to communicate directly or indirectly with the camera 1100 and/or base unit 1000 using a wireless or wired connection. The sensor 1170 may be configured to detect a state of/or condition of and store or transmit the results. The sensor 1170 may not be wirelessly powered from the base unit 1000. In an example, the sensor 1170 and the camera 1100 are located within the same housing.
In an example, the system 20 may include a light (e.g., a flashlight or a flash associated with the camera), a rangefinder, a laser, a microphone, a holster, a firearm, an audio recorder, and/or other articles or devices. The articles or devices may be or comprise an electronic device 200. In an example, a firearm may comprise a laser sight. The base unit 1000 may wirelessly charge and/or communicate with one or more of these components. One or more of these features may be integrated into the camera of these components. One or more of these features may be integrated into the camera 1100, the base unit 1000, and/or it may be a separate component. In an example, a 1100, the base unit 1000, and/or it may be a separate component. In an example, a component may be configured to turn on and/or start recording when another electronic component may be configured to turn on and/or start recording when another electronic device is turned on or activated. For example, an audio recording may begin when the camera is turned on or activated. For example, an audio recording may begin when the camera 1100 begins recording.

The systems and methods described herein (such as system 20) may find applications in police, military, and/or security forces, such as with firearms, holsters, utility belts, hats. Systems and methods described herein may be used with a duty belt or other wearable device for holding or storing devices. Devices worn or stored on a duty belt may include: a radio, a walkie-talkie, handcuffs, chemical sprays, flashlights, ammunition, a baton, disposable gloves, a knife, a multi-tool, a first aid kit, a notebook, and/or other items. In some examples, the duty belt may include a sensor for determining when an item of the duty belt is accessed.

FIG. 16 illustrates an example wireless camera system 30, including a firearm 32, a holster 34, a base unit 1200, a camera 1300, and a sensor 1370. The base unit 1200 may include some or all of the components and features of other base units 1200 described herein (e.g., base unit 100, 300, or 1000). The base unit 1200 may be described herein (e.g., base unit 100, 300, or 1000). The base unit 1200 may be integrated with and/or coupled to the holster 34 in some examples. In an example, the base unit 1200 may be worn on a duty belt. The camera 1300 may include some or all of the components and features of other cameras described herein (e.g., camera 1100). The sensor 1370 may include some or all of the components and features of other sensors described herein (e.g., sensor 1170).

The firearm 32 may be a weapon configured to launch any kind of projectile. The firearm 32 may be limited to gunpowder-based firearms or lethal weapons. In an example, the firearm 32 may include non-lethal weapons, less-than-lethal weapons, or other devices, such as an airfoil, tear gas, etc. dispersant, a chemical agent (e.g., pepper spray, tear gas, and/or mace) dispersant, a laser-based chemical agent (e.g., pepper spray, tear gas, and/or mace) dispersant, a laser-based...
weapon, an acoustic-based weapon, and/or other devices. The holster 34 may be a
weapon, an acoustic-based weapon, and/or other devices. The holster 34 may be a
device for holding or storing a weapon, such as the firearm 32. The holster 34, may
maintain the device in a stored configuration. In an example, the holster 34 may be
a firearm holster, such as the one illustrated in FIG. 16. In an example, the holster 34
may be a weapon, a firearm rack, a firearm safe, a firearm scabbard, a strap, a pocket, cover
and/or any other kind of device or housing for holding, storing, or stowing a firearm or
weapon. In an example, the holster 34 may include the base unit 1200.

In an example, the camera 1300 is mounted to an underside of the firearm 32.
In another example, the camera 1300 may be configured to be mounted or attached to
various portions of the firearm 32, including but not limited to: a slide, a barrel, a
trigger guard, a grip, a magazine, a sight, a forestock, a muzzle, a hand
mounting rail, a NATO accessory rail, or other components. In another
element, the camera 1300 may be mounted to an existing accessory of the firearm 32,
such as a mounted flashlight or laser sight. The placement of the camera may be
selected so as not to interfere with the operation of the firearm 32. In an example, the
camera 1300 receives power from a power source of the firearm 32. For example, the
power source may be a power source for an accessory of the firearm 32 (e.g., a
flashlight, a laser sight, or other accessory) or for the firearm 32 itself (e.g., when the
firearm 32 is an electroshock weapon).

In an example, the sensor 1370 is a sensor configured to detect a state of the
firearm 32. The sensor 1370 may be a component of the camera 1300, associated with
the camera 1300, and/or separate from the camera 1300. In an example, the sensor
1370 may be located on the firearm 32, the holster 34, or in other locations. The sensor
1370 may be configured to detect whether the firearm 32 is within a holster 34 or is
otherwise in a stowed position. In an example, the sensor 1370 is a photosensor or a
UV sensor that is blocked from receiving light when the firearm is stored but
receives light when the firearm is in the open. The sensor 1370 may be a separation
sensor that detects whether the sensor 1370 is separated from or near a component
located within the holster 34. In an example, the firearm 32, the camera 1300, and/or
the sensor 1370 may be configured to wirelessly receive power when the firearm 32 is
stored in the holster, and the sensor 1370 may be configured to detect whether the firearm 32,
the camera 1300, and/or the sensor 1370 is receiving power (e.g., inductively or
conductively) from an external source, such as the base unit 1200. In an example, the camera 1300 is configured to record data when the camera is not receiving power. The sensor 1370 may be a movement-sensor that detects a pattern of movement associated with a firearm 32 being moved out of a holster 34, or otherwise out of a stowed position. In another example, the sensor 1370 may be configured to detect whether the firearm 32 has been discharged. The sensor 1370 may be configured to detect vibrations, accelerations, noises, or other conditions associated with discharge of the firearm 32. In another example, the sensor 1370 may be configured to detect whether a firearm 32 has been discharged.

[0123] The holster 34 may be configured with one or more sensors 1370 to detect a state of the holster 34 or a device disposed within the holster, such as the firearm 32. The state may include whether the firearm 32 is disposed within the holster 34, whether a strap-keeping the firearm 32 in place is secured, whether the holster 34 is being worn, or other states. The holster 34 and/or a base unit 1200 may be configured to wirelessly charge a component of the firearm 32 (e.g., a flashlight, a camera, a laser sight, a component of the holster 34, a component of a belt, a component of a microcomputer, biometrics, etc.) or other features or accessories of the firearm 32, while the firearm 32 is holstered.

[0124] Based on a state detected by the sensor 1370, the base unit 1200 may change a parameter and/or take an action. For example, the action may be to power a particular electronic device or to send a signal to cause the electronic device to begin recording. In an example, the base unit 1200 may charge an electronic device using a first charging method when the device is in or near the holster 34 and using a second charging method when the device is away from the holster 34 but still within a charging range. The base unit 1200 may be configured to automatically provide power to the camera 1300 when the firearm 32 leaves the holster 34. The camera 1300 may be configured to automatically begin recording and transmit recorded data when it receives power. The camera 1300 may be configured to include a rechargeable battery and have been configured to turn on when automatically based on a sensor. The camera may be configured to turn on automatically based on a sensor.
camera 1300 may be configured to begin or end recording based on whether the firearm is in a stored configuration, such as when the firearm is stored within the holster.

FIG. 17 illustrates an example system 40, including a flashlight 42, a base unit 1400, a camera 1500, and a sensor 1370. The base unit 1400 may include some or all of the components and features of other base units described herein (e.g., base unit 100, 300, 1000, or 1200). The camera 1500 may include some or all of the components and features of other cameras described herein (e.g., camera 1100 or 1300). The sensor 1370 may include some or all of the components and features of other sensors described herein (e.g., sensor 1170 or 1370). In an example, the system 40 does not include the base unit 1400.

The flashlight 42 may be a handheld, gun-mounted, wearable (e.g., on a shoulder or on the head), and/or another kind of flashlight configured to provide light. In an example, the flashlight 42 may be only one of or both of a flashlight configured for use by a user to illuminate an area (e.g., a police issue flashlight) and an illumination source configured to support the recording of a camera by providing light (e.g., a camera, flashlight, or a spot light for recording). In an example, the flashlight 42 is inductively coupled to and receives power from the base unit 1400. In an example, the flashlight 42 is configured to inductively or conductively receive power when in a stored position (e.g., when the flashlight is stored in a holster). In an example, the area may include or support a base unit (e.g., base unit 1400).

The camera 1500 may be disposed on an exterior surface of the flashlight 42, be incorporated into the light source of the flashlight 42, be located in an area between the light sources of the flashlight 42 (e.g., between LED lighting elements of the flashlight 42), be located on a glass of the flashlight 42, or in other areas. In an example, the camera 1500 may be configured to operate without a base unit. The camera 1500 may be configured to
receive power through a wired or wireless connection to the power source of the

The sensor 1570 may be configured to detect or determine whether the
flashlight 42 is on or off. The sensor 1570 may be electrically coupled to the flashlight
or AND otherwise separated from the flashlight 42. The sensor 1570 may be a photosensor
configured to determine whether the flashlight 42 is producing light, the sensor 1570
may be disposed over or connected to a button or switch used to turn the flashlight 42
may be disposed over or connected to a button or switch used to turn the flashlight 42
on or off and be configured to be sense when a user turns on the flashlight 42. In an
example, the sensor 1570 is configured to operate without a base unit. The sensor 1570
may be configured to receive power from the power source of the flashlight 42.

FIG. 18 illustrates an example wireless camera system 50, including headgear
52, a base unit 1600, cameras 1700, and a sensor 1770. The headgear 52 may be any
kind of article worn on the head, including but not limited to a hat, a helmet, goggles,
glasses, or other headgear. The headgear 52 may include an energy harvesting device
(such as solar chargers). In an example the headgear 52 is a peaked cap traditionally
worn by police officers. The base unit 1600 may include some or all of the components
and features of other base units described herein (e.g., base unit 1100, 300, 11000, 1200,
or 1400). The cameras 1700 may include some or all of the components and features of
other cameras described herein (e.g., camera 1100, 1300, or 1500). The sensor 1770
may include some or all of the components and features of other sensors described
herein (e.g., sensor 1170, 1370, or 1570). The headgear 52 may be a platform on which
the headgear 52 may be a platform on which the cameras 1700 are located. The cameras 1700
may include different portions of the headgear 52, such as a left side, top side, right side, back side, or other locations
of the headgear 52, such as a left side, top side, right side, back side, or other locations
(e.g., a brim of a hat). In an example, there are cameras 1700 that are facing forward,
temporally, rearwardly, and/or in other directions. The cameras 1700 may be
configured or arranged to provide a view approximating at what the wearer of the
headgear 52 is looking.

FIG. 19 illustrates an example wireless camera system 60, including headgear
52, a base unit 1600, cameras 1700, and sensor 1770. The headgear 52 may include an
antenna that is connectable to the cameras 1700. In the system 60, the base unit 1600 is
apart of the headgear 52. In another example, the base unit is attached to a front portion of
the headgear 52. The base unit may be located in other locations, such as at a brim of
the headgear 52. The base unit may be located in other locations, such as at a brim of
the headgear 52, a strap of the headgear 52, at an interior area of the headgear, or in other locations. The cameras 1700 may be arranged on a single structure mounted on the headgear 52.

Fig. 20 illustrates an example wireless camera system 70, including a user 5, a firearm 52, a holster 34, a flashlight 42, headgear 52, cameras 1700, and a base unit 1800. The base unit 1800 may include some or all of the components and features of other base units described herein (e.g., base unit 100, 300, 1200, 1400, or 1600), other base units described herein (e.g., base unit 100, 300, 1000, 1200, 1400, or 1600).

In an example, the base unit may be worn on a strap passing diagonally over the right shoulder of the user 5. The system 20 also includes a remote, other party 72. The other party 72 may include a supervisor, an administrator, a server, a computer, nearby security personnel, a dispatcher, or other parties. In an example, the party 72 may receive information from the cameras 1900 and sensors worn by the user 5. The information may be live or delayed. The base unit 1800 may include a cellular radio, Wi-Fi antenna, or other component configured to communicate to the remote party 72.

The base unit 1800 may be configured to store the information until it reaches a particular location (e.g., an area with an internet connection) and then automatically or manually transmit the information to the party 72.

Fig. 21 illustrates a flowchart of a process 2000 involving a base unit, sensors, and a camera in accordance with examples herein. In the example in Fig. 21, a base unit may receive a state from a sensor, as shown in block 2005. The state may be a state in response to which a user desires recording to begin or end. The sensor may be a state in response to which a user desires recording to begin or end. The sensor may be a sensor mounted to a device, such as a firearm or flashlight. In an example, the sensor mounted to a device, such as a firearm or flashlight. In an example, the sensor may detect a state of a device, such as that a firearm has been removed from a holster, may detect a state of a device, such as that a firearm has been removed from a holster, that a firearm has been returned to the holster, that a firearm is in the holster, that a firearm was ready for firing, that a firearm had its safety turned off, that a firearm had its safety turned on, and/or that a firearm has been discharged. In another example, the sensor may detect a state of a firearm, for example, that the firearm has been turned on, that the flashlight is running low on power, that the flashlight has no more power, that the flashlight has been turned off, all or other states. In another example, the state may be a state of a user, such as heart rate, blood pressure, a temperature of the user, or other states. In another example, the state may be the state of an environment, such as temperature, noise, humidity, toxicity, or other states of an environment. In another
example, the state may be the state of a vehicle, such as speed, acceleration, deceleration, location, or other states. In an example, the sensor is configured to detect an indication from a user or another party that recording should begin. For example, the sensor may detect a state indicating that a button has been pushed, a switch has been flipped, a voice command given, or other such indication. In an embodiment, the sensor may transmit an indication of the state to another party. For example, the base unit may transmit an indication of the state to another party. For example, the base unit may receive a state indicating that a firearm is out of a holster and the base unit may transmit an indication of this state to another party. The indication may include metadata regarding the event, including but not limited to the location of the event, information of a user associated with the event, and/or other information.

- **Example 1:** The base unit may take an action with respect to a camera based on the state, as in block 2010. In an example, the base unit may transmit power to the camera responsive to the state. For example, the base unit may transmit power to the camera responsive to a state indicating that a firearm is out of a holster. If another example, the base unit may transmit power to the camera responsive to a state indicating that an event should be recorded. In an example, the camera may be instructed to record data responsive to the state. For example, the base unit may instruct the camera to record data responsive to the state, such as a state indicating that a firearm is out of a holster, that a flashlight is turned on, or other such indications. In an example, the sensor may be configured to detect a state indicating that a firearm is out of a holster, that a flashlight is turned on, or there is a likelihood of an interest occurring. For example, in an example, the base unit may transmit power to the camera responsive to a state or a combination of states meeting certain rules. In an example, the camera may be instructed to begin recording responsive to a heart rate event, the camera may be instructed to begin recording responsive to a heart rate event, and the camera may transmit information to the camera responsive to a state or a combination of states meeting certain rules. In an example, the camera may be instructed to begin recording responsive to a heart rate event, and the camera may transmit information to the camera responsive to a state or a combination of states meeting certain rules. In an example, the camera may be instructed to begin recording responsive to a heart rate event, and the camera may transmit information to the camera responsive to a state or a combination of states meeting certain rules.
recording mode. The camera may switch from the first power mode to the second recording mode. The camera may switch from the first power mode to the second power mode responsive to receiving additional power from base unit, and/or, receiving a command. In an example, the camera is a camera located on the device of which the state was received. For example, the state may have been collected from a sensor on a firearm and the base unit may transmit power to a camera on a firearm. In an example, the base unit may transmit power or an instruction to record to all available cameras. For example, the base unit may receive a state indicating that a flashlight has been turned on and then wirelessly transmits power to cameras located on headgear, a firearm, and the flashlight.

The base unit may wirelessly receive data from the camera, as in block 2105. In an example, the camera may record data and transmit the data to the base unit while it is receiving power and/or while it is instructed to record and transmit. In an example, the camera stores data until a later event. For example, the camera may record and store data until the camera is in close proximity to the base unit or a receiver (e.g., because the firearm has been returned to a holster). In an example, the base unit receives an indication that a firearm has been removed from a holster. In response, the base unit may transmit power and/or an instruction to record to a camera, which begins recording. In an example, the camera is configured to record or instructed to record based on a sensor. The sensor may provide an indication that the firearm is no longer inside of a holster. In an example, the sensor may provide an indication that the firearm is in a stored configuration in the holster. In an example, the base unit and/or the camera transmits or relays the received data to a remote party for storage, backup, review, or viewing. In an example, metadata is collected regarding the received data. For example, timestamp and/or geo-location data may be collected. In another example, example, timestamp and/or geo-location data may be collected. In another example, information about the user associated with the camera and/or base unit is collected.

By careful specification of the use cases for the charging system of the wearable device, a wireless power transfer system can be optimized to produce an improved arrangement of charging conditions while preserving form factor through a reduction of arrangement of charging conditions while preserving form factor through a reduction of battery size needed to normally charge a device for its typical use period between charging cycles. Depending on applications, the electronic device may not need to be intentionally placed in a manner to facilitate charging, since the power transmitted at the use case distance may be adequate for maintaining the energy draw from the system of the battery. Distance may be adequate for maintaining the energy draw from the system on the battery.
The above detailed description of examples is not intended to be exhaustive or to limit the method and systems to the precise form disclosed above. While specific embodiments of, and examples for, the method and systems for wireless power transfer are described above for illustrative purposes, various equivalent modifications are possible within the scope of the system, as those skilled in the art will recognize. For example, while processes or blocks are presented in a given order, alternative embodiments may perform routines having operations, or employ systems having blocks, in a different order, and some processes or blocks may be deleted, moved, added, subdivided, combined, and/or modified. While processes or blocks are at times shown as being performed in series, these processes or blocks may instead be performed in parallel, or may be performed at different times. It will be further appreciated that one or more components of base units, electronic devices, or systems in accordance with specific examples may be used in combination with any of the components of base units, electronic devices, or systems of any of the examples described herein.
CLAIMS

What is claimed is:

1. A firearm comprising:
   a camera attached to the firearm and configured to receive power when
   the firearm is in a stored configuration; and
   a sensor electrically coupled to the camera and configured to detect
   whether the firearm is in the stored configuration,
   wherein, the camera is configured to record data responsive to the sensor
detecting the firearm is not in the stored configuration.

2. The firearm of claim 1, wherein the camera is configured to cease recording
data responsive to the sensor detecting the firearm is in the stored configuration.

3. The firearm of claim 1, wherein the camera comprises a receiver configured
to receive energy.

4. The firearm of claim 1, wherein the stored configuration comprises the firearm
being secured by a holster, a firearm rack, a firearm safe, a firearm scabbard, a strap, a
cover, a pocket, or a housing for the firearm.

5. The firearm of claim 1, wherein the sensor is a UV sensor, a photosensor, a
pressure sensor, or a motion sensor.

6. The firearm of claim 1, wherein the camera attached to the firearm is configured
to inductively receive power when the firearm is in a stored configuration.

7. The firearm of claim 1, wherein the camera attached to the firearm is configured
to receive power by way of wireless power transfer or energy harvesting.
8. The firearm of claim 1, wherein the camera comprises a rechargeable battery or a capacitor.

9. A firearm holster comprising:
   a transmitter configured for wireless power delivery to a camera mounted on a firearm configured for placement in the firearm holster;
   a power source configured to the transmitter, the power source comprising a battery or a port configured to receive power;
   a controller coupled to the power source and the transmitter, wherein the controller is configured to cause the transmitter to selectively transmit power from the power source to the firearm when the firearm is placed in the firearm holster;
   a receiver configured to receive sensed data from the camera; and
   memory configured to store the received, sensed data.

10. The firearm holster of claim 9, wherein the transmitter and the receiver are integrated in a transceiver.

11. The firearm holster of claim 9, wherein the firearm holster is configured to maintain the firearm in a stored configuration and comprises a firearm rack, a firearm safe, a firearm scabbard, a strap, a cover, a pocket, or a housing for the firearm.

12. The firearm holster of claim 9, further comprising a housing enclosing the transmitter, the power source, the controller, the receiver, and the memory, and wherein the housing is coupled to the firearm holster.

13. The firearm holster of claim 9, wherein the transmitter comprises a coil comprising a magnetic core.

14. The firearm holster of claim 13, wherein the coil of the transmitter is inductively coupled to a coil of the camera when the firearm is placed in the firearm holster.
15. The firearm holster of claim 9, wherein:

- the receiver is further configured to receive a signal from a sensor; and
- the controller is configured to cause the transmitter to selectively transmit power from the power source to the camera responsive to the received signal.

16. The firearm holster of claim 15, wherein the sensor is a heart rate sensor, a photosensor, a thermal sensor, an O2 sensor, a CO sensor, a CO2 sensor, an air quality sensor, a radiation sensor, a UV sensor, a pressure sensor, a motion sensor, or an accelerometer.

17. The firearm holster of claim 15, wherein the sensor is configured to detect whether the firearm is in the firearm holster.

18. Headwear comprising:

- a transmitter configured for wireless power delivery to a camera mounted on the headwear;
- a power source coupled to the transmitter, the power source comprising a battery or a port configured to receive power;
- a controller coupled to the power source and the transmitter and configured to cause the transmitter to selectively transmit power from the power source to the camera;
- a receiver configured to receive sensed data from the camera; and
- memory configured to store the received, sensed data.

19. The headwear of claim 18, further comprising a housing enclosing the transmitter, the power source, the controller, the receiver, and the memory, and wherein the housing is coupled to the headwear.

20. The headwear of claim 18, wherein the headwear comprises a hat or a helmet.
21. The headwear of claim 18, wherein the coil of the transmitter is inductively coupled to a coil of the camera.

22. The headwear of claim 18, wherein:

   the receiver is further configured to receive a signal from a sensor; and
   the controller is configured to cause the transmitter to selectively transmit
   power from the power source to the camera responsive to the received signal.

23. The headwear of claim 22, wherein the sensor is a heartrate sensor, a photosensor, a thermal sensor, an O₂ sensor, a CO sensor, a CO₂ sensor, an air quality sensor, a radiation sensor, a UV sensor, a pressure sensor, a motion sensor, or an accelerometer.

24. A method comprising:

   receiving, at a base unit, a state of a device remote from the base unit;
   responsive to the state of the device, wirelessly transmitting instructions to
   begin recording from the base unit to a camera mounted to the device; and
   wirelessly receiving data from the camera at the base unit.

25. The method of claim 24, wherein the device is a flashlight and the state comprises the flashlight producing light.

26. The method of claim 24, wherein the device is a firearm and the state comprises the firearm being away from a holster.

27. The method of claim 24, further comprising transmitting the data from the base unit to another party.
TRANSMIT INTERROGATION SIGNAL WITH BASE UNIT  

BROADCAST SIGNAL FROM AN ELECTRONIC DEVICE  

MOVE THE BASE UNIT AND/OR THE ELECTRONIC DEVICE PROXIMATE TO EACH OTHER  

DETECT AN ELECTRONIC DEVICE IN PROXIMITY OF THE BASE UNIT  

WIRELESSLY TRANSMIT POWER SIGNALS TO THE ELECTRONIC DEVICE  

DETECT A CHANGE IN STATE OF THE BASE UNIT  

IS THE BASE UNIT STATIONARY?  

YES  

TRANSMIT IN HIGH POWER MODE  

NO  

TRANSMIT IN LOW POWER MODE  

FIG. 4
FIG. 5
FIG. 11

FIG. 12

SUBSTITUTE SHEET (RULE 26)
FIG. 21

1. RECEIVE A STATE
2. TAKE AN ACTION WITH RESPECT TO A CAMERA BASED ON THE STATE
3. WIRELESSLY RECEIVE DATA FROM THE CAMERA
INTERNATIONAL SEARCH REPORT

INTERNATIONAL SEARCH REPORT

PCT/US20 15/067921

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F41C 27/00 (2016.01)
CPC - F41A 17/06 (2016.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - F41C 27/00; F41G 1/00, 11/00; G03B 29/00 (2016.01 )

CPC - F41A 17/06; F41 H 13/0025; H05C 1/06 (2016.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 42/146; 396/426, 429; 420/90 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Orbit, Google Patents, Google Scholar, Google

Search terms used: camera, firearm, receiving, images, holster.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 2010/0284683 A1 (FRESSOLSA et al) 11 November 2010 (11.11.2010) entire document</td>
<td>1, 3-8 ***</td>
</tr>
<tr>
<td>A</td>
<td>US 7,937,880 B1 (FIDLOW) 10 May 2011 (10.05.2011) entire document</td>
<td>1-8</td>
</tr>
<tr>
<td>A</td>
<td>US 8,046,948 B2 (MAUCH) et al) 01 November 2011 (01.11.2011) entire document</td>
<td>1-8</td>
</tr>
<tr>
<td>A</td>
<td>US 6,735,897 B1 (SCHMITTER) 18 May 2004 (18.05.2004) entire document</td>
<td>1-8</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority claimed

"F" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"G" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"H" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"K" document member of the same patent family

Date of the actual completion of the international search

08 April 2016

Date of mailing of the international search report

2.9 APR 2016

Name and mailing address of the ISA:

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450
Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)
INTERNATIONAL SEARCH REPORT

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. □ Claims Nos.:
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. □ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

This International Searching Authority found multiple inventions in this international application, as follows:

See supplemental page

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ✗ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-8

Remark on Protest

1. The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

2. The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

3. No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (January 2015)
INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/067921

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-8, drawn to a firearm.
Group II, claims 9-23, drawn to wireless power delivery to a camera mounted on a firearm.
Group III, claims 24-27, drawn to a method comprising: receiving, at a base unit, a state of a device remote from the base unit.

The inventions listed as Groups I, II and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a sensor electrically coupled to the camera; the camera is configured to record data responsive to the sensor detecting the firearm is not in the stored configuration as claimed therein is not present in the invention of Groups II and III. The special technical feature of the Group II invention: a controller coupled to the power source and the transmitter and configured to cause the transmitter to selectively transmit power from the power source as claimed therein is not present in the invention of Groups I or III. The special technical feature of the Group III invention: wirelessly transmitting instructions to begin recording from the base unit as claimed therein is not present in the invention of Groups I or II.

Groups I, II and III lack unity of invention because even though the inventions of these groups require the technical feature of a firearm; receiving data from the camera; deliver power to a camera mounted on a firearm, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2008/0163536 A1 (KOCH et al) 10 July 2008 (10.07.2008) teaches a firearm (Abstract); receiving data from the camera (the digital computer unit comprises an image processing computer that allows at least a selectable image portion of the image data received from the video cameras, Para. 23); deliver power to a camera mounted on a firearm (a sighting mechanism for a firearm, including a video camera, wherein power is delivered to the video camera through an electrical power supply, Abstract and Para. 45).

Since none of the special technical features of the Group I, II or III inventions are found in more than one of the inventions, unity of invention is lacking.