(Figure 8), or any other intelligent electronic device connector. Replicated connector 930 provides a connector on sleeve 900 to replicate the connector on the intelligent electronic device that mates with mating connector 910. IED interface 920 provides a compatible interface protocol for sleeve 900 to communicate through mating connector 910 and replicated connector 930.

Add-on slot 960 is a slot compatible with an electronic transaction card. For example, add-on slot 960 may be a slot such as add-on slot 110 (Figure 1), add-on slot 210 (Figure 2), add-on slot 510 (Figure 5), or add-on slot 810 (Figure 8). Electronic transaction card interface 950 a compatible interface protocol for sleeve 900 to communicate through add-on slot 960.

Data routing circuitry 940 provides a communication path between IED interface 920 and electronic transaction card interface 950. In some embodiments, data routing circuitry 940 includes digital circuitry such as latches, buffers, multiplexers, and the like. Also in some embodiments, data routing circuitry 940 may include sequential circuitry such as state machines. Further, data routing circuitry 940 may include a processor such as a microprocessor, microcontroller, digital signal processor (DSP), or the like. Data routing circuitry 940 may be implemented as a separate block as shown in Figure 9, or may be distributed between other blocks shown in Figure 9. For example, data routing circuitry 940 may be distributed between IED interface 920 and electronic transaction card interface 950.

Power source 970 provides power for the circuit blocks shown in Figure 9. in some embodiments, power source 970 includes a battery, such as battery 830 (Figure 8). Also in some embodiments, power source 970 includes a charger port to couple an external charger to a battery, and in still further embodiments, power source 970 is omitted. In some embodiments, power for the various blocks shown in Figure 9 is provided by an intelligent electronic device through mating connector 910.

Figure 10 shows a block diagram of a sleeve. Sleeve 1000 includes IED interface 920, replicated connector 930, data routing circuitry 940, electronic

Single transaction account numbers may be generated by the card issuer or locally by either an intelligent electronic device or an electronic transaction card. Generation of STANs may be accomplished in any of several ways. For example, when an electronic transaction card is issued, the cardholder may receive several pre-assigned single-use transaction numbers. The numbers may also have a pre-specified sequence. In some embodiments, this sequence may be known only to the issuing bank and the cardholder's intelligent electronic device and/or electronic transaction card. A card issuing bank may authorize payments based on the expected sequence of account numbers, and if out-of-sequence account numbers are used, then the issuing bank may consider that transaction as a potentially fraudulent transaction. The issuing bank may also use this feature to track the merchant involved in the potentially fraudulent transaction.

According to another example, a pre-assigned sequence of STANs may be reset to the original starting number on the list depending on user input or other triggers. In addition, the list of numbers may be periodically downloaded via a cellular phone network or other network connectivity.

Figure 2B shows intelligent electronic device 230 and electronic transaction card 240. Intelligent electronic device 230 is an example of a "wearable" device that is capable of communicating with an electronic transaction card. For example, intelligent electronic device 230 is shown having the form factor of a wristwatch. Some embodiments of the present invention may have other wearable form factors. For example, a wearable intelligent electronic device may be worn in such a manner that it contacts human skin, or it may be worn on clothing. Any wearable intelligent electronic device may be employed without departing from the scope of the present invention. Further, intelligent electronic device 230 may have any of the capabilities described herein.

Intelligent electronic device 230 may include an add-on slot to accept electronic transaction card 230. The add-on slot may be any of the add-on slot embodiments described herein. Electronic transaction card 240 may be any

electronic transaction card. For example, electronic transaction card 240 may be any electronic transaction card embodiment described herein.

Figure 3 shows a block diagram of an electronic transaction card. Electronic transaction card 300 is an electronic transaction card capable of communicating with an intelligent electronic device, and capable of communicating with a magnetic card reader. For example, electronic transaction card 300 may be electronic transaction card 104 (Figure 1) or electronic transaction card 220 (Figure 2A).

Electronic transaction card 300 includes electrical contacts 302, intelligent electronic device (IED) interface 304, nonvolatile memory 306, processing device 308, volatile memory 310, magnetic field producing circuits 312, swipe sensor 314, and stripe 320.

Electrical contacts 302 correspond to electrical contacts 108 (Figure 1). IED interface 304 is coupled to electrical contacts 302 to provide a communications interface between electronic transaction card 300 and an intelligent electronic device. For example, IED interface 304 may be an interface compatible with an add-on slot such as add-on slot 110 (Figure 1) or add-on slot 210 (Figure 2A).

Magnetic field producing circuit 312 includes one or more circuits to produce time-varying magnetic fields at or near the location of stripe 320. For example, one or more current carrying conductors may be excited to produce a magnetic field, and the current may be varied in amplitude and reversed in polarity to cause the magnetic field to be time-varying. In some embodiments, the number of magnetic field producing circuits corresponds to the number of tracks being emulated for stripe 320. For example, stripe 320 may emulate two, three, four, or more magnetic tracks on a magnetic card such as a credit card. In these embodiments, electronic transaction card 300 may include two, three, four, or more magnetic field producing circuits 312. Magnetic field producing circuits 312 may also include circuits to allow control of the time-varying magnetic field. For example, magnetic field producing circuits 312 may include voltage drivers, current drivers, registers to hold digital data, sequential circuits to translate the digital data to magnetic fields, and the like.

Swipe sensor 314 senses when electronic transaction card 300 has been swiped in a magnetic card reader, and provides a swipe indication to processing device 308. The swipe sensor may be a mechanical switch, an electronic switch, or any other type of suitable switch. For example, a mechanical switch may get pressed when electronic transaction card 300 is swiped. Also for example, an electrical sensor may include two or more contacts (not shown) that get shorted when swiped past a metal head within a card reader. Further, a Hall effect sensor or light-based sensor may be utilized. The present invention is not limited by the type of swipe sensor utilized. In some embodiments, swipe sensor 314 is omitted.

Processing device 308 represents a processor capable of communicating with the other blocks shown in electronic transaction card 300. For example, processing device 308 may be a microprocessor, a digital signal processor (DSP), a microcontroller, or the like. Further, processing device 308 may be formed from state machines or other sequential logic. In operation, processing device 308 may read instructions from volatile memory 310 and/or nonvolatile memory 306 and perform actions in response thereto. For example, processing device 308 may execute program instructions that influence communications between electronic transaction card 300 and an intelligent electronic device, or between electronic transaction card 300 and a magnetic card reader.

Volatile memory 310 represents memory that may lose its state when power is removed from electronic transaction card 300. For example, volatile memory 310 may be static random access memory (SRAM). Volatile memory 308 may be utilized by processing device 308 when executing programs. For example, a program may be copied into volatile memory 308 prior to execution. Also for example, processing device 308 may use volatile memory 308 to store data during the execution of a program.

Nonvolatile memory 306 represents memory that does not lose its state when power is removed from electronic transaction card 300. Nonvolatile memory 306 may be any suitable type of memory such as Flash memory with floating gate

transistor memory cells. Examples include NOR Flash memory, NAND Flash memory, and multibit/cell Flash memory.

Nonvolatile memory 306 may hold program instructions that are executable by processing device 308. For example, prior to being sold, a manufacturer or distributor may program nonvolatile memory 306 with program information to influence the operation of electronic transaction card 300. Also for example, an intelligent electronic device may provide program information to electronic transaction card 300 through IED interface 304.

Nonvolatile memory 306 may also hold program instructions that are executable by a processing device other than processing device 308. For example, a manufacturer, distributor, reseller, or other participant in the chain of commerce may program nonvolatile memory 306 with program information to be transferred to an intelligent electronic device. Information to be transferred may include device drivers, application software, or the like.

Electronic transaction card 300 may include one or more power sources (not shown). For example, electronic transaction card 300 may include a battery or a capacitor such as a supercapacitor. In some embodiments, a rechargeable battery may be included. The rechargeable battery may accept a charge from an add-on slot in an intelligent electronic device. In some embodiments, a capacitor may accept a charge from an intelligent electronic device. The capacitor may provide power to electronic transaction card 300 for enough time to perform a transaction. Further, the capacitor may be sized to ensure that a transaction may only be performed during a limited time period after removing the electronic transaction card from an add-on slot, thereby ensuring that a stolen card may not be used repeatedly without the cardholder's consent. Also in some embodiments, electronic transaction card 300 may be programmed to go dormant if a transaction is not performed within a limited time period after removing the card from an intelligent electronic device.

Electronic transaction card 300 may include one or more integrated circuits. For example, processing device 308 may be on one integrated circuit die, and the memories may be on another integrated circuit die. In some embodiments, all active

devices are included on a single integrated circuit die. In some embodiments, various integrated circuit dice are mounted on a common substrate to provide a high level of integration using separate dice. Any amount of circuit integration may be practiced without departing from the scope of the present invention.

Electronic transaction card 300 has dimensions "*a*" and "*b*." In some embodiments of the present invention, stripe 320 has a length that is substantially equal to *a*, and in some embodiments, stripe 320 has a length less than *a*. Further, in some embodiments, *a* is less than the stripe length of a standard credit card (approximately three and three eighths inches), and in some embodiments, *a* is much less than the stripe length of a standard credit card. For example, in some embodiments, *a* is less than 75% the length of a standard credit card stripe. Further, in some embodiments, *a* is less than 50% the length of a standard credit card stripe. In still further embodiments, *a* is less than 25% the length of a standard credit card stripe.

In some embodiments, dimensions *a* and *b* are substantially equal to the dimensions of a memory card. For example, dimensions *a* and *b* may conform to the dimensions of an MMC memory card, a Memory Stick PRO DUO memory card, or other memory card. Further, in some embodiments, electronic transaction card 300 has a thickness compatible with a magnetic card reader.

Figure 4 shows an electronic transaction card and a card reader. Electronic transaction card 410 is a card having a stripe compatible with a magnetic card reader. For example, electronic transaction card 410 may be electronic transaction card 104 (Figure 1), electronic transaction card 220 (Figure 2A), electronic transaction card 300 (Figure 3), or any other electronic transaction card described herein. Magnetic card reader 420 is a card reader compatible with magnetic cards. For example, magnetic card reader 420 may operate as part of a merchant point-of-sale terminal, an access control device, or the like. When a magnetic card is swiped through magnetic card reader 420, one or more time-varying magnetic fields are produced relative to the location of a magnetic read head (not shown) in magnetic card reader 420.

In the operation depicted in Figure 4, electronic transaction card 410 is swiped through magnetic card reader 420. During the swiping operation, electronic transaction card 420 produces one or more time-varying magnetic fields to emulate the swiping of a magnetic card. For example, a swipe sensor within electronic transaction card 410 may detect the swiping action depicted in Figure 4, and a magnetic field producing circuit may generate one or more time-varying magnetic fields as electronic transaction card 410 passes by a magnetic read head in magnetic card reader 420.

Figure 5 shows an intelligent electronic device, an electronic transaction card, and a magnetic card reader. Electronic transaction card 510 is shown being swiped through magnetic card reader 520 while attached to intelligent electronic device 500. The operation depicted in Figure 5 represents a transaction occurring while electronic transaction card 510 is coupled to an add-on slot of intelligent electronic device 500.

Figure 6 shows an adapter for use with an electronic transaction card. Adapter 600 includes a body portion having dimensions "*w*" and "*l*", and a receiving portion shown at 610. Adapter 600 is useful to receive an electronic transaction card at receiving portion 610 to provide a larger card having the functionality of an electronic transaction card. For example, in some embodiments of the present invention, dimensions *w* and *l* are compatible with swallow-type magnetic card readers, and a combination of adapter 600 an electronic transaction card may be compatible with such readers.

Receiving portion 610 may include an interface compatible with a connector on an electronic transaction card. For example, an electronic transaction card may have an interface that is compatible with both an add-on slot of an electronic transaction device and receiving portion 610 of adapter 600.

Figure 7 shows adapter 600 having an electronic transaction card 710 coupled thereto. Electronic transaction card 710 includes a stripe capable of emitting one or more time-varying magnetic fields as described above. The combination of electronic transaction card 710 and adapter 600 allow the

functionality of electronic transaction card 710 to be useful in the larger form factor of adapter 600.

In some embodiments, adapter 600 includes active or passive circuitry in support of the operation of electronic transaction card 710. For example, adapter 600 may include electrical contacts, a battery, an integrated circuit, or other circuits. Also for example, adapter 600 may include one or more swipe sensors to provide a swiping indication to electronic transaction card 710.

Figure 8 shows an adapter having a smartcard interface 810. In embodiments represented by Figure 8, an adapter may be utilized to perform a transaction involving a smartcard reader while utilizing an electronic transaction card. For example, an electronic transaction card may be coupled to adapter 800 at receiving portion 820, and the electronic transaction card may provide data useful for a smartcard transaction.

Figure 9 shows an electronic transaction card having a smartcard interface. Electronic transaction card 900 includes electrical contacts 908 and 910. Electrical contacts 908 are similar to electrical contacts 108 (Figure 1). For example, electrical contacts 908 may be compatible with an add-on slot of an intelligent electronic device such as intelligent electronic device 102 (Figure 1). Electrical contacts 910 are arranged to provide the communications interface to a smartcard reader.

In some embodiments, electronic transaction card 900 includes a smartcard interface as well as a stripe to produce the time-varying magnetic field. For example, as shown in figure 10, the backside of electronic transaction card 900 may include stripe1010. The various electronic transaction cards described herein may include a stripe, a smartcard interface, or a combination thereof.

Figure 11 shows an adapter in combination with an electronic transaction card. Adapter 1100 is shown having electronic transaction card 900 coupled in a recessed portion on a side having dimension *w*. In some embodiments, this configuration places electrical contacts 910 at a location expected by smartcard readers.

Figure 12 shows an adapter having an aperture to receive an electronic transaction card. Adapter 1200 includes aperture1210 to receive an electronic transaction card. In some embodiments, aperture 1210 passes completely through adapter 1200, and in other embodiments, aperture 1210 is a recessed portion on the face of adapter 1200. Adapter 1200 may receive electronic transaction cards having a stripe, a smartcard interface, or a combination of the two.

Figure 13 shows and adapter having a body portion 1300, a recessed portion 1310, and stripe 1320. Recessed portion 1310 may receive an electronic transaction card as described above with respect to Figures 6-7. Further, stripe 1320 may be utilized to communicate with a magnetic card reader. For example, adapter 1300 may include a magnetic field producing circuit such as magnetic field producing circuit 312 (Figure 3) to produce a time-varying magnetic field. In operation, an electronic transaction card may be coupled to adapter 1300 at recessed portion 1310, and provide transaction information to be used by stripe 1320 for a transaction with a magnetic card reader. In some embodiments, an electronic transaction card having neither a stripe nor a smartcard interface may be coupled to adapter 1300 at recessed portion 1310 to effect a transaction using stripe 1320.

The various adapters shown in the previous figures may have recessed portions, apertures, or stripes anywhere on the adapter without departing from the scope of the present invention. For example, in some embodiments, a recessed portion may be on the side of the adapter having a smaller dimension, and in other embodiments a recessed portion may be on the side of the adapter having a larger dimension. Also for example, in some embodiments, a stripe may be on the side of the adapter having a smaller dimension, and in other embodiments a stripe may be on the side of the adapter having a larger dimension.

Figure 14 shows an electronic transaction card. Electronic transaction card 1400 includes stripe 1410 and add-on slot compatible portion 1402. Add-on slot compatible portion 1402 includes electrical contacts 1408 to communicate with an add-on slot in an intelligent electronic device. For example, add-on slot compatible

portion 1402 may be physically and electrically compatible with add-on slot 110 (Figure 1) or add-on slot 210 (Figure 2A).

Electronic transaction card 1400 may include any of the circuits, features, or functionality described herein. For example, electronic transaction card 1400 may include magnetic field producing circuits, swipe sensors, processing devices, volatile and nonvolatile memory, various interfaces, and electrical contacts.

Electronic transaction card 1400 is shown having stripe 1410 along an edge having dimension "*l*." In some embodiments, electronic transaction card 1400 may have stripe 1410 along an edge other than that shown in Figure 14.

In operation, electronic transaction card 1400 may be left coupled to an electronic transaction device when being swiped through a magnetic card reader, similar to the operation shown in Figure 5. Further, electronic transaction card 1400 may be removed from an intelligent electronic device prior to being swept through a magnetic card reader, similar to the operation shown in Figure 4.

Figure 15 shows an electronic transaction card and an adapter in combination. The combination of electronic transaction card 1400 and adapter 1500 form a card having dimensions "*w*" and "*l*" as described above with reference to previous figures. The resulting card may be suitable for swallow-type magnetic card readers.

Figure 16 shows a combination electronic transaction card and adapter 1610 being inserted into a swallow-type magnetic card reader. As shown in Figure 16, the swallow-type magnetic card reader is part of an automated teller machine (ATM), but this is not a limitation of the present invention. For example, the swallow-type reader may be part of a point-of-sale device, an access entry device, or any other type of device capable of incorporating a swallow-type magnetic card reader.

Figure 17 shows a combination electronic transaction card and adapter being swiped through a magnetic card reader. Adapter 1710 and electronic transaction card 1720 are shown being swiped through magnetic card reader 1730. Electronic transaction card 1720 maybe any of the electronic transaction card embodiments

described herein. For example, electronic transaction card 1720 may include a stripe, a smartcard interface, or a combination of the two. Although adapter 1710 is shown as an adapter having a recessed portion on one side, the combination adapter/card in Figure 17 represents any of the adapter/ card combinations described herein. For example, adapter 1710 may be any of adapters 600 (Figures 6,7), adapter 800 (Figure 8), adapter 1100 (Figure 11), adapter 1200 (Figure 12), adapter 1300 (Figure 13), or adapter 1500 (Figure 15).

Figure 18 shows a financial transaction card. Financial transaction card 1800 includes stripe 1802, financial card circuits 1804, memory card emulation circuitry 1806, and memory card compatible interface 1808. Financial transaction card 1800 is an example of a financial card that might be issued by a bank or other financial institution. For example, financial transaction card 1800 might be a debit card, a credit card, a stored value card, or other card issued for the purposes of financial transactions.

Financial card circuits 1804 interact with stripe 1802 to produce time-varying magnetic fields compatible with a magnetic card reader. For example, financial card circuits 1804 and stripe 1802 may provide financial transaction data to a point-of-sale terminal. Financial transaction card 1800 also includes memory card emulation circuitry 1806 to emulate the operation of a memory card. The combination of memory card emulation circuitry 1806 and memory card compatible interface 1808 allow financial transaction card 1800 to perform as a memory card. For example, memory card compatible interface 1808 may be compatible with a memory card interface in an add-on slot of an intelligent electronic device.

Figure 19 shows a memory card. Memory card 1900 includes memory card compatible interface 1930, memory card circuits 1920, financial card emulation circuitry 1910, and stripe 1902. Memory card 1900 is an example of a card that may be fabricated and sold by a memory card manufacturer or a manufacturer that is in the business of selling electronic peripheral devices. By including financial card emulation circuitry 1910 and stripe 1902 in memory card 1900, the manufacturer of memory card 1900 may add features desired by consumers. For example, the

combination of stripe 1902 and financial card emulation circuitry 1910 may emulate the operation of a financial card such as a credit card, debit card, stored value card, or the like.

Figure 20 shows a block diagram of a combination memory card and electronic transaction card. Card 2000 includes memory 2010, processing element 2020, magnetic/smartcard circuitry 2030, card reader interface 2040, memory card circuitry 2050, and memory card slot compatible interface 2060. Processing element 2020 may be any processing element suitable to communicate with memory 2010 and the other blocks shown in Figure 20. Magnetic/smartcard circuitry 2030 may include circuits to produce time-varying magnetic fields or signals compatible with a smart card reader. Card reader interface 2040 may include a stripe as described above, or may include electrical contacts compatible with a smartcard reader. Memory card circuitry 2050 may be any type of memory circuitry accessible by an intelligent electronic device. The intelligent electronic device may access memory card circuitry 2050 through memory card slot compatible interface 2060.

Memory 2010 is shown having card software 2012 and application software 2014. In some embodiments, card 2000 is sold or distributed having both card software 2012 and application software 2014 in memory 2010. For example, memory 2010 may be nonvolatile memory having card software 2012 for execution by processing element 2020. Also for example, memory 2010 may have application software 2014 meant to be installed on a device other than card 2000. Application software 2014 may include drivers, user interface software, single transaction account number (STAN) generation software, or any other software that may be installed on a device other than card 2000.

Application software 2014 may operate in any of multiple languages on multiple operating systems. For example, application software 2014 may provide a user interface in any regional language. Also for example, application software 2014 may run on any operating system (OS).

Figure 21 shows a block diagram of how card 2000 (Figure 20) may be utilized. A card issuer 2110 may issue card 2000 to a cardholder 2130. As issued by card issuer 2110, card 2000 may include card software and application software as shown in Figure 21. Cardholder 2130 may couple card 2000 with intelligent electronic device 2140 and install application software on the intelligent electronic device. For example, intelligent electronic device 2140 may be a mobile phone capable of executing application software, and card 2000 may supply application software to be installed on the mobile phone. Also for example, intelligent electronic device 2140 may be a non-telephonic device such as a personal digital assistant (PDA), or other dedicated hardware, capable of receiving card 2000 in an add-on slot.

Figure 22 shows a block diagram of a combination memory card and electronic transaction card. Card 2200 includes processing element 2020, magnetic/smartcard circuitry 2030, card reader interface 2040, memory card circuitry 2050, and memory card slot compatible interface 2060, all of which are described above with reference to Figure 20. Card 2200 also includes nonvolatile memory 2210 and volatile memory 2220. As shown in Figure 22, nonvolatile memory 2210 includes card software 2212 to be executed by processing element 2020. Also as shown in Figure 22, card 2200 includes volatile memory 2220 having financial transaction data 2222 held therein. Financial transaction data 2222 may be programmed into volatile memory 2220 by processing alignment 2020 in response to communications from an intelligent electronic device coupled to memory card slot compatible interface 2060. For example, a mobile phone executing single transaction account number generation software may provide a single transaction account number as financial transaction data that gets stored in volatile memory 2220 in preparation for a transaction. In other embodiments, financial transaction data 2222 represents two, three, four, or more time-varying magnetic fields to be generated by the combination of magnetic/smartcard circuitry 2030 and card reader interface 2040.

Figure 23 shows a block diagram of a phone and a card. Phone 2310 may be a cellular telephone, and card 2350 may be any of the electronic transaction card embodiments described herein. Phone 2310 includes display 2312, processor 2314, single transaction account number (STAN) generation software 2316, and authentication software 2318. Card 2350 includes processor 2352, card software 2354, financial transaction data 2356, and point-of-sale (POS) interface 2358.

Single transaction account number generation software 2316 may be installed on the phone 2310 when card 2350 is inserted in a memory slot. For example, referring now back to Figures 20 and 21, STAN generation software 2316 may correspond to application software 2014. Authentication software 2318 may only allow authorized users access to phone 2310 and/or card 2350.

In operation, a user interacting with phone 2310 may gain access to features by satisfying requirements of authentication software 2318. Using STAN generation software 2316, a user may generate financial transaction data 2356 which is held on card 2350 in preparation for a transaction. Card 2350 may then interact with a card reader using point-of-sale interface 2358 to effect a transaction. This transaction may be effected with card 2350 coupled to phone 2310 or decoupled from phone 2310. Further, the transaction using card 2350 may be effected while card 2350 is coupled to any of the adapter embodiments described herein.

The following paragraphs provide further disclosure of various invention embodiments. Each embodiment is fully defined by the recitation of the corresponding paragraph, and no other elements are to be considered essential for that particular embodiment. The embodiments include:

A. An apparatus comprising:
a stripe to communicate with a magnetic card reader; and
an interface to communicate with an intelligent electronic device;
wherein the apparatus has dimensions smaller than a credit card.

A1. The apparatus of A wherein the stripe includes circuitry to produce at least one time-varying magnetic field.

A2. The apparatus of A wherein the interface is compatible with an add-on slot in the intelligent electronic device.

A3. The apparatus of A2 wherein the interface comprises a memory card interface.

A4. The apparatus of A further comprising a processing element coupled to the interface and to the stripe.

A5. The apparatus of A4 further comprising a memory element to hold programming information for the stripe.

A6. The apparatus of A4 further comprising an embedded swipe sensor to sense when the stripe is swiped through a magnetic card reader.

A7. The apparatus of A further comprising nonvolatile memory accessible by the intelligent electronic device.

B. A financial card comprising:
a point-of-sale compatible electronic transaction stripe;
a memory card compatible interface; and
memory card emulation circuitry coupled to the memory card compatible interface.

C. A memory card comprising:
a memory card compatible interface;
a point-of-sale compatible electronic transaction stripe; and

financial card emulation circuitry coupled to the point-of-sale compatible electronic transaction stripe.

D. A financial card apparatus comprising:

a point-of-sale compatible portion having a stripe to communicate with a point-of-sale transaction device; and

a memory card compatible portion having at least one electrical contact to communicate with a memory card slot in an intelligent electronic device.

E. A memory card comprising:

a memory card interface operable to couple the memory card to an intelligent electronic device;

a nonvolatile memory device accessible through the memory card interface; and

a stripe operable to communicate with a magnetic card reader.

F. A memory card comprising:

a memory card slot interface; and

circuitry for producing a time-varying magnetic field compatible with a magnetic card reader.

F1. The memory card of F wherein the circuitry is configured to produce a plurality of time-varying magnetic fields compatible with a point-of-sale transaction device.

G. An apparatus comprising:

means for communicating through a memory card slot in an intelligent electronic device;

means for producing at least one time-varying magnetic field to represent financial transaction data; and

means for storing the financial transaction data.

H. A card comprising:

a memory card compatible interface;

a smartcard compatible interface; and

a stripe to produce at least one time-varying magnetic field compatible with a magnetic card reader.

I. A memory card compatible with a memory card slot in a mobile phone, the memory card including nonvolatile memory accessible by the mobile phone, a point-of-sale interface to communicate with a point-of-sale terminal, and volatile memory to hold financial transaction data.

I1. The memory card of I wherein the point-of-sale interface comprises circuitry to produce at least one time-varying magnetic field.

I2. The memory card of I1 further including a processing device coupled to the nonvolatile memory, volatile memory, and point-of-sale interface.

J. An electronic financial transaction device having a thickness compatible with a point-of-sale card reader, a width less than a credit card width, a length less than a credit card length, an electronically programmable stripe situated along the length, and at least one electrical contact to provide an interface to an intelligent electronic device.

J1. The electronic financial transaction device of J wherein the at least one electrical contact comprises a memory card interface compatible with a memory card slot in the intelligent electronic device.

J2. The electronic financial transaction device of J wherein the electronically programmable stripe includes a circuit to emulate a magnetic stripe in a credit card.

J3. The electronic financial transaction device of J2 further comprising a swipe sensor to detect when the electronic financial device is swiped through a point-of-sale terminal.

K. A card comprising:

means for storing financial transaction data;

means for communicating with a memory card slot in an intelligent electronic device; and

means for creating a time-varying magnetic field that represents the financial transaction data.

K1. The card of K wherein the means for storing financial transaction data comprises volatile memory.

K2. The card of K wherein the financial transaction data comprises a single transaction account number.

K3. The card of K further comprising a processing device coupled to read the financial transaction data and influence the operation of the means for creating a time-varying magnetic field.

L. An adapter for use with any of A-K, the adapter comprising:

a body portion having exterior dimensions larger than dimensions of A-G; and

a receiving portion to receive any of A-G, wherein the receiving portion is located on the body portion to expose any of A-G for use in magnetic card reader transactions.

M. An apparatus comprising a body portion with dimensions compatible with a swallow-type magnetic card reader, wherein the body portion includes a memory card compatible area to receive a memory card with magnetic stripe functionality.

M1. The apparatus of M further comprising a smartcard interface.

M2. The apparatus of M further comprising at least one electrical component coupled to the memory card compatible area portion to interface to the memory card.

M3. The apparatus of M wherein the memory card compatible area comprises a recessed portion of at least one side of the apparatus.

M4. The apparatus of M wherein memory card compatible area comprises at least one metallic contact on a periphery of an aperture in the apparatus.

N. A financial card to be used with a magnetic card reader at a point-of-sale, the financial card including a memory card interface to allow the financial card to be inserted in a memory card slot of a mobile phone, and including a stripe compatible with the magnetic card reader, wherein the stripe is shorter than a magnetic credit card stripe.

O. A card compatible with a magnetic card reader and compatible with a memory slot in an intelligent electronic device, the card including software to be installed on the intelligent electronic device.

O1. The card of O wherein the software includes a module for single transaction account number generation.

O2. The card of O1 wherein the software is configured to run on a mobile phone.

O3. The card of O wherein the card comprises:
a memory slot compatible portion; and
a magnetic card reader compatible portion.

O4. The card of O3 wherein the magnetic card reader compatible portion comprises circuitry to produce at least one time-varying magnetic field for use in a financial transaction.

P. A card comprising:
a memory card interface mechanically compatible with a memory card slot in an intelligent electronic device;
a processing device coupled to the memory card interface; and
circuitry to produce a time-varying magnetic field compatible with a point-of-sale device.

Q. A card comprising:
a memory card interface electrically compatible with a memory card slot in an intelligent electronic device;
a processing device coupled to the memory card interface; and
circuitry to produce a time-varying magnetic field compatible with a point-of-sale device.

Q1. Any of the cards of P-Q further comprising nonvolatile memory exposed through the memory card interface.

Q2. Any of the cards of P-Q further comprising volatile memory to hold financial transaction information.

Q3. Any of the cards of P-Q further comprising a software component that when executed by the processing device causes the circuitry to produce at least one time-varying magnetic field representing the financial transaction information.

Q4. Any of the cards of P-Q further comprising a visible stripe at which the at least one time-varying magnetic field emanates.

Q5. Any of the cards of P-Q further comprising a battery.

Q6. Any of the cards of P-Q further comprising a capacitor to provide power to the card.

Q7. The card of Q wherein the card has a size substantially equivalent to a credit card.

R. A credit card sized adapter to receive any of the cards of P-Q.

R1. The adapter of R wherein the credit card sized adapter includes a smartcard interface.

R2. The adapter of R wherein the adapter includes a first edge having a width and a second edge having a length, wherein the second edge includes a recessed portion to accept the card.

R3. The adapter of R wherein the credit card sized adapter includes a first edge having a width and a second edge having a length, wherein the first edge includes a recessed portion to accept the card.

S. A combination financial card and memory card apparatus comprising:
electrical contacts to provide an interface to a mobile phone;

a transaction stripe to produce at least one time-varying magnetic field representing transaction information;

a processing device; and

a software component to receive the transaction information from the mobile phone;

wherein the electrical contacts are provided on a physical portion of the combination financial card and memory card apparatus having dimensions compatible with a memory card slot.

S1. The combination financial card and memory card apparatus of S further comprises an application software component to be installed on the mobile phone.

T. In combination:

a memory card having a transaction stripe compatible with a magnetic card reader; and

a credit card sized adapter to receive the memory card and to expose the transaction stripe for use in magnetic card reader transactions.

U. In combination:

a memory card having an interface compatible with a memory card slot in a mobile phone and a smartcard interface; and

a credit card sized adapter to receive the memory card and to expose the smartcard interface for use in smartcard transactions.

V. A financial transaction system comprising:

a mobile phone having a memory card slot;

a memory card compatible with the memory card slot, wherein the memory card includes circuitry to transmit financial transaction data to a point-of-sale device; and

a software component to produce single transaction account numbers for use as financial transaction data.

W. A system comprising:

a wearable intelligent electronic device having a card slot; and

a card comprising a card slot interface and circuitry for producing a time-varying magnetic field compatible with a magnetic card reader.

Although the present invention has been described in conjunction with certain embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art readily understand. Such modifications and variations are considered to be within the scope of the invention and the appended claims.

What is claimed is:

1. A memory card compatible with a memory card slot in a mobile phone, the memory card including nonvolatile memory accessible by the mobile phone, a point-of-sale interface to communicate with a point-of-sale terminal, and volatile memory to hold financial transaction data.

2. The memory card of claim 1 wherein the point-of-sale interface comprises circuitry to produce at least one time-varying magnetic field.

3. The memory card of claim 2 further including a processing device coupled to the nonvolatile memory, volatile memory, and point-of-sale interface.

4. The memory card of claim 1 wherein the point-of-sale interface includes an electronic stripe that emulates a magnetic stripe.

5. The memory card of claim 4 further comprising an embedded swipe sensor to sense when the electronic stripe is swiped through the point-of-sale terminal.

6. The memory card of claim 1 wherein the point-of-sale interface includes a smartcard interface.

7. The memory card of claim 1 further including software to be installed on the mobile phone.

8. The memory card of claim 7 wherein the software includes a module for single transaction account number generation.

9. An apparatus comprising:

means for communicating through a memory card slot in an intelligent electronic device;

means for producing at least one time-varying magnetic field to represent financial transaction data; and

means for storing the financial transaction data.

10. The apparatus of claim 9 further including software to be installed on the intelligent electronic device.

11. The apparatus of claim 10 wherein the software includes a module for single transaction account number generation.

12. The apparatus of claim 11 wherein the software is configured to run on a mobile phone.

13. The apparatus of claim 9 further comprising nonvolatile memory accessible through the means for communicating through a memory card slot.

14. The apparatus of claim 9 further comprising means to sense whether the memory card has been swiped through a magnetic card reader.

15. An electronic transaction card comprising:

a memory card slot interface; and

circuitry for producing a time-varying magnetic field compatible with a magnetic card reader.

16. The electronic transaction card of claim 15 wherein the circuitry is configured to produce a plurality of time-varying magnetic fields compatible with a point-of-sale transaction device.

17. The electronic transaction card of claim 16 further comprising nonvolatile memory accessible via the memory card slot interface.

18. The electronic transaction card of claim 15 further comprising a processing device coupled to the memory card slot interface and the circuitry for producing a time-varying magnetic field.

19. The electronic transaction card of claim 18 further comprising a software component that when executed by the processing device causes the circuitry to produce the time-varying magnetic field.

20. The electronic transaction card of claim 18 further comprising software to be transferred to a device other than the electronic transaction card.

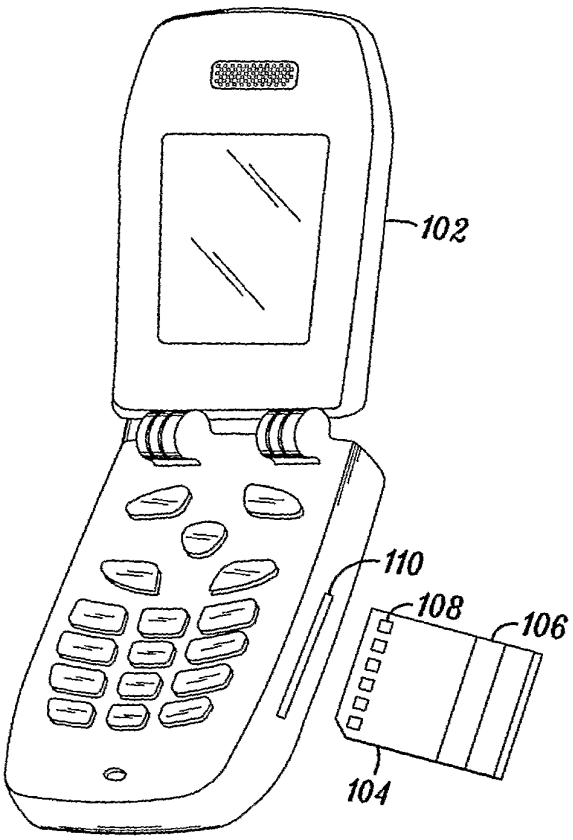


FIG. 1

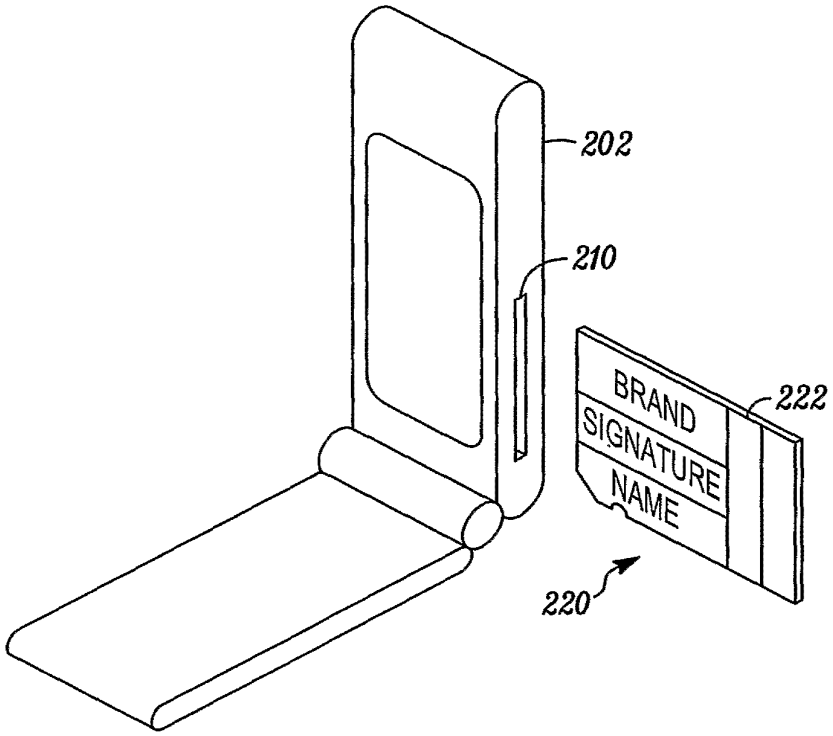


FIG. 2A

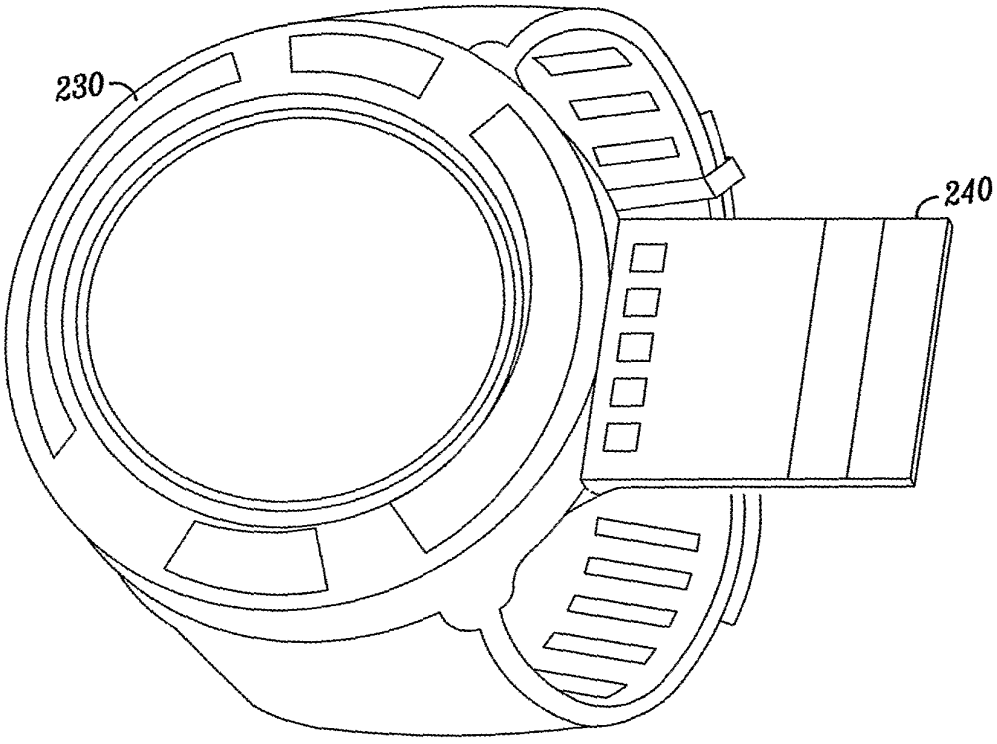


FIG. 2B

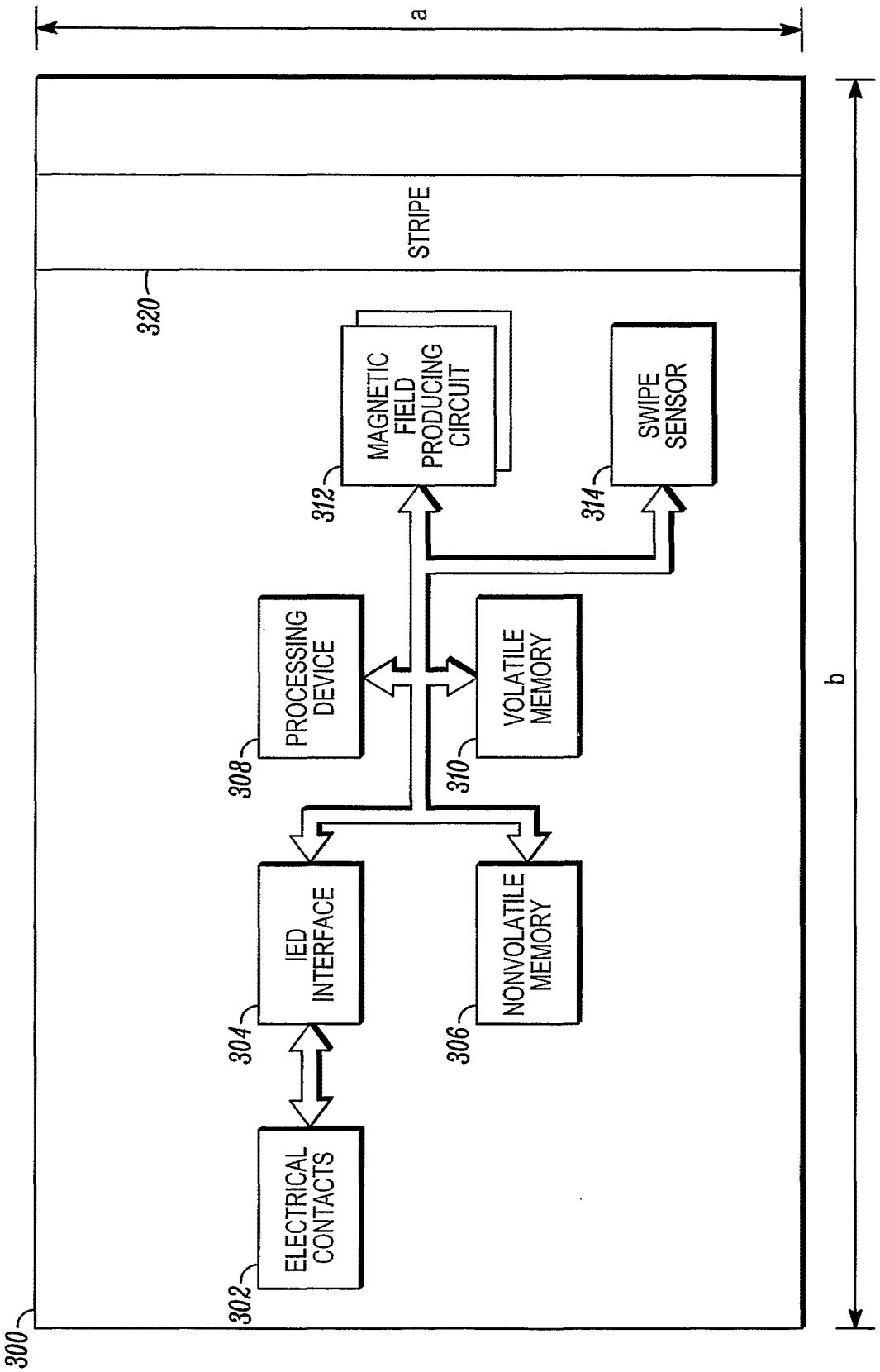

a
b
STRIPE
320
MAGNETIC FIELD PRODUCING CIRCUIT
312
SWIPE SENSOR
314
PROCESSING DEVICE
308
VOLATILE MEMORY
310
IED INTERFACE
304
NONVOLATILE MEMORY
306
ELECTRICAL CONTACTS
302
300

FIG. 3

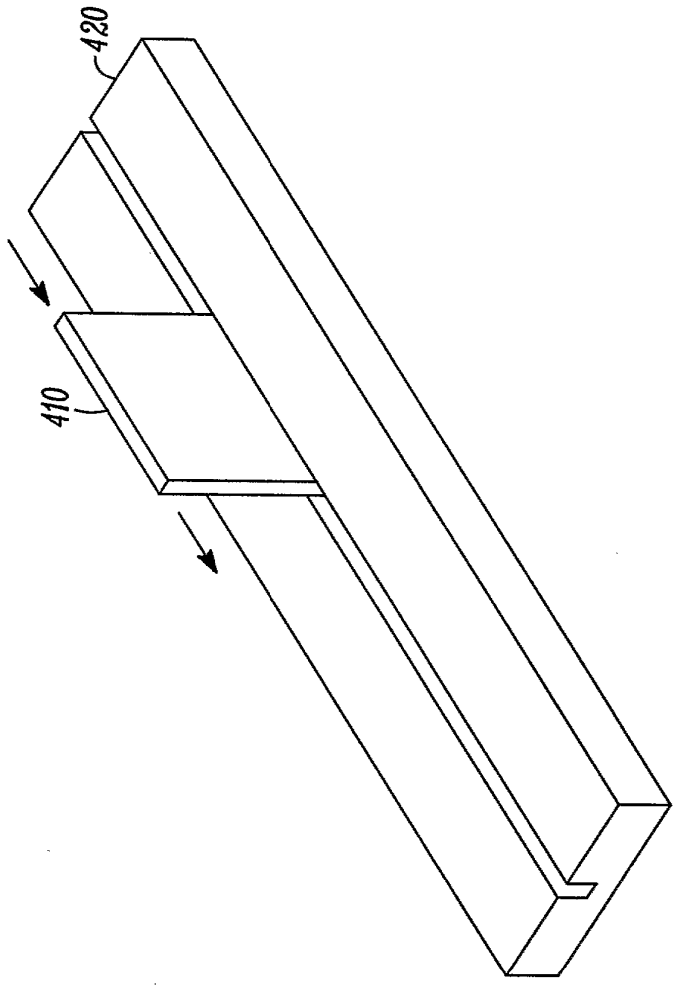


FIG. 4

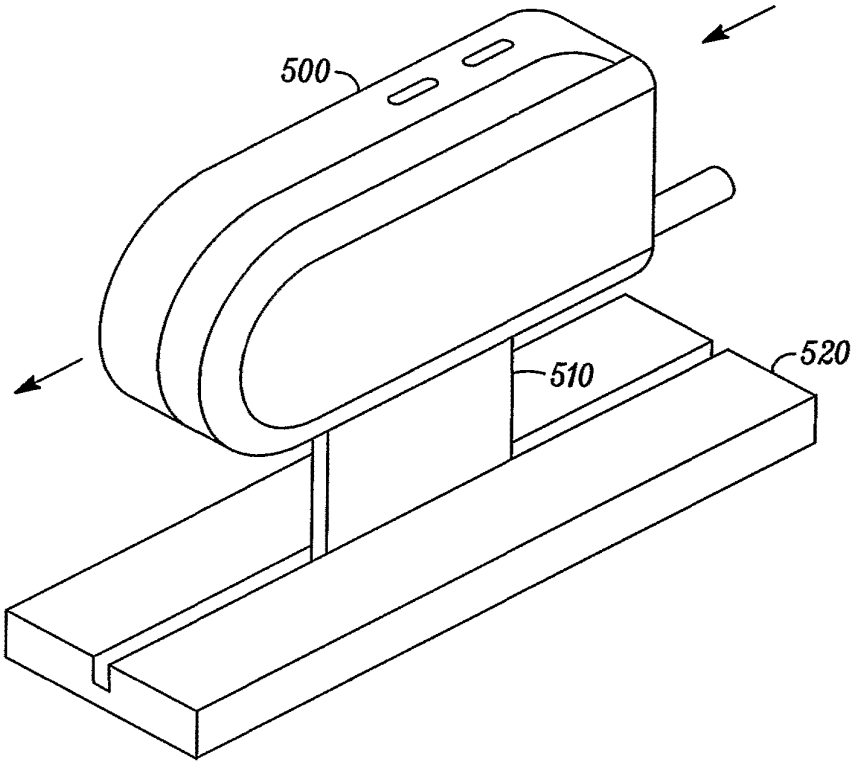


FIG. 5

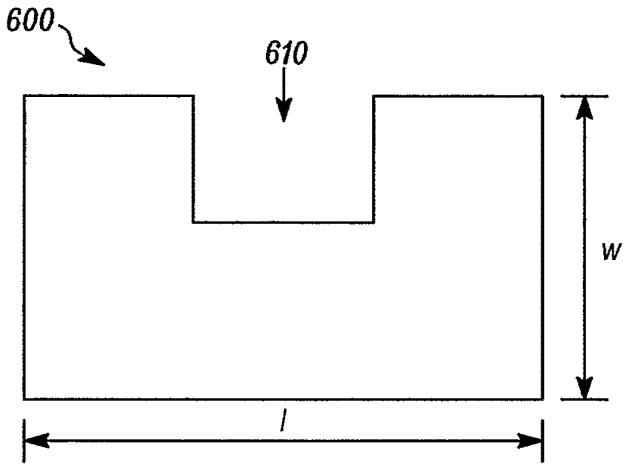


FIG. 6

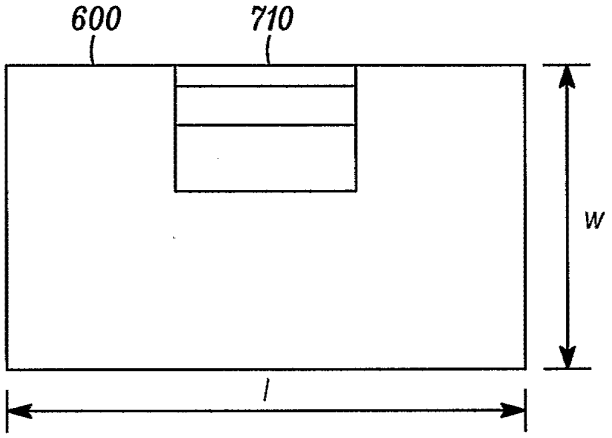


FIG. 7

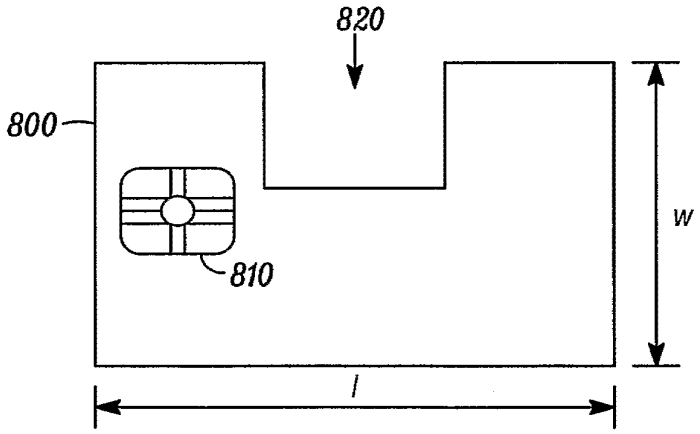


FIG. 8

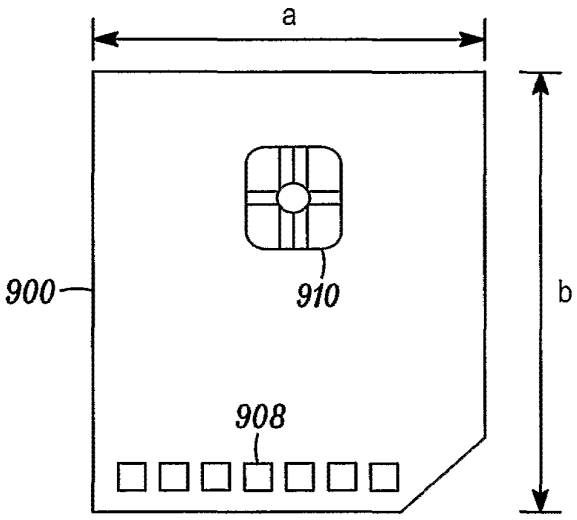


FIG. 9

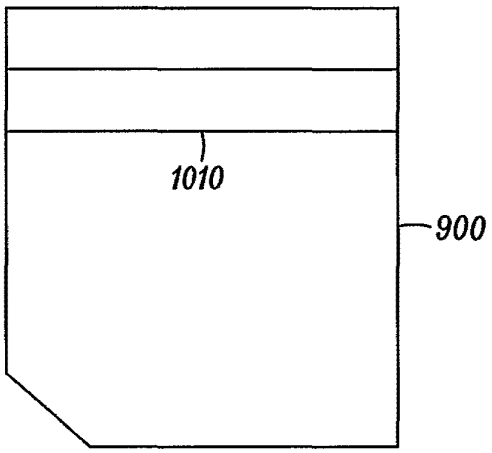


FIG. 10

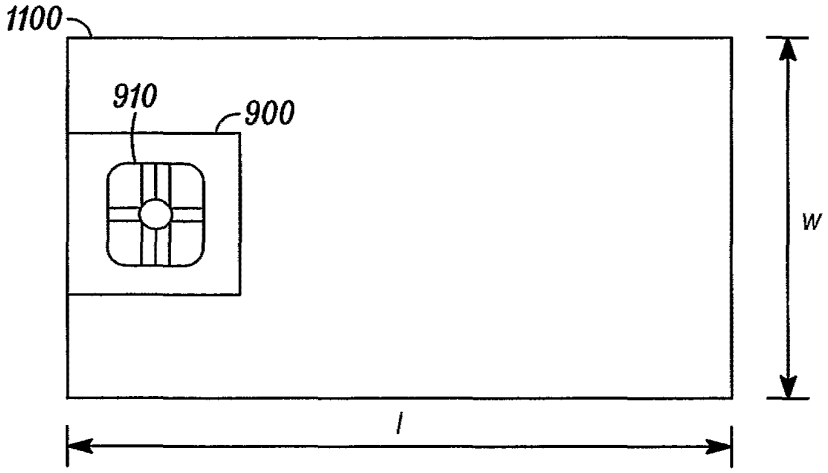


FIG. 11

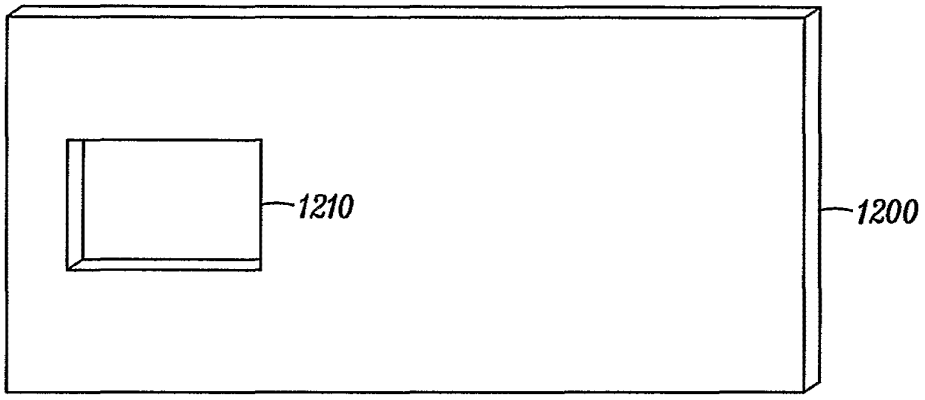


FIG. 12

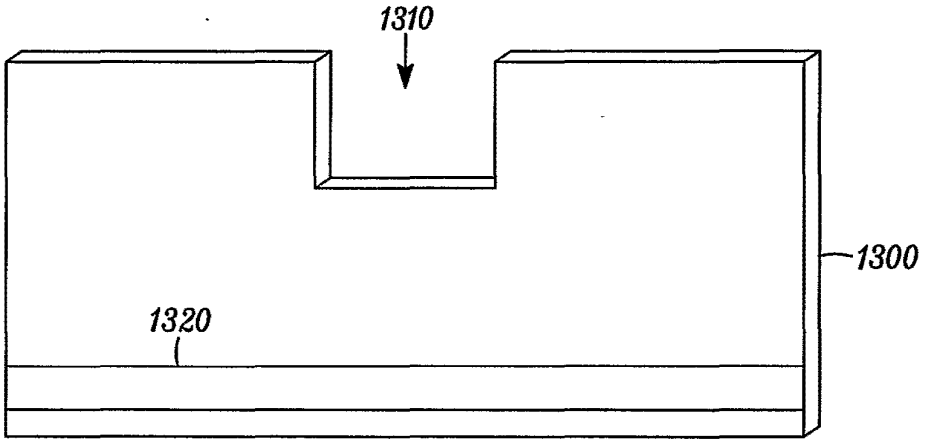


FIG. 13

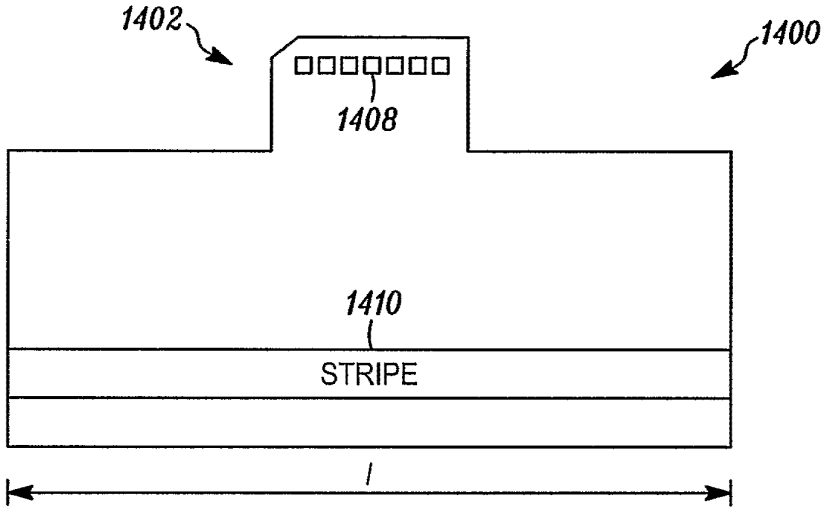


FIG. 14

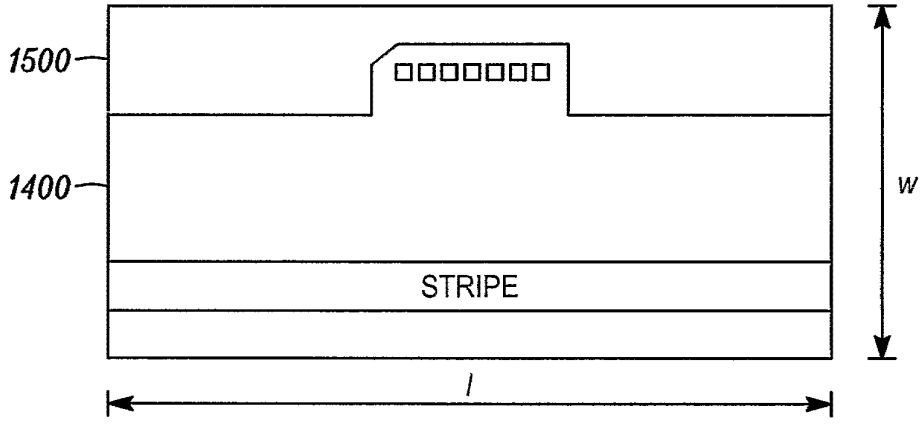


FIG. 15

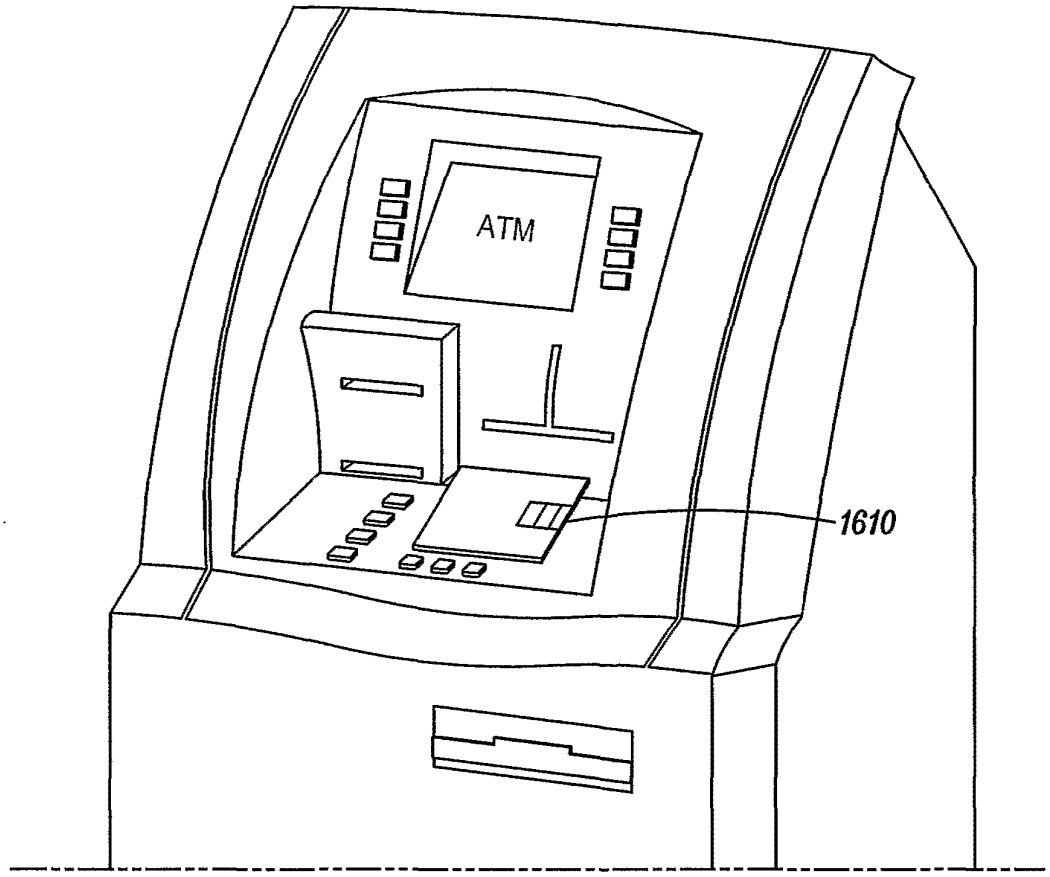


FIG. 16

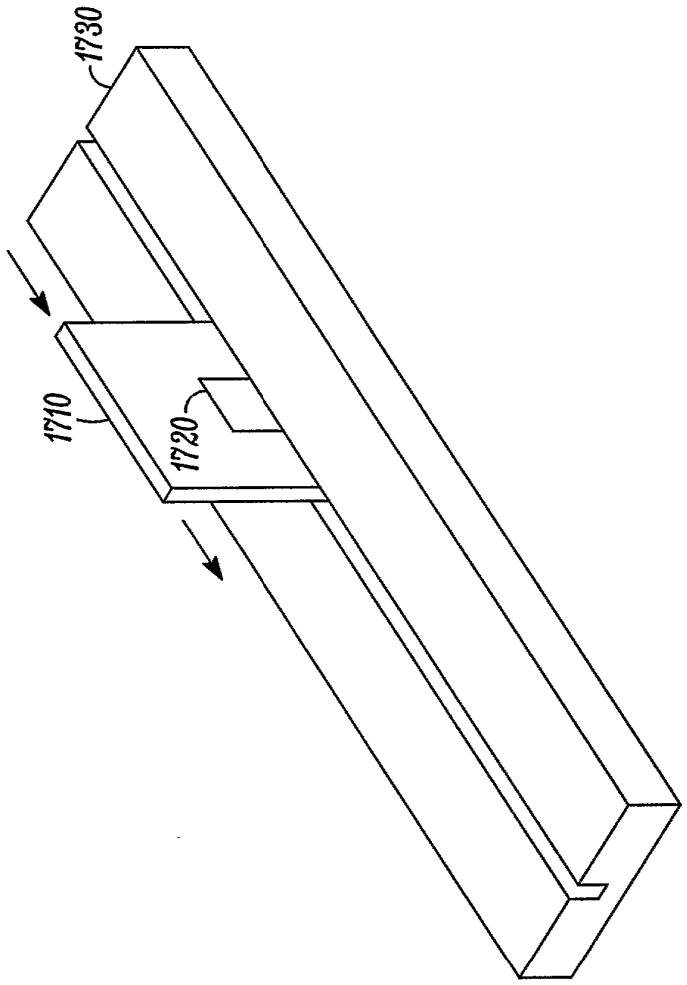


FIG. 17

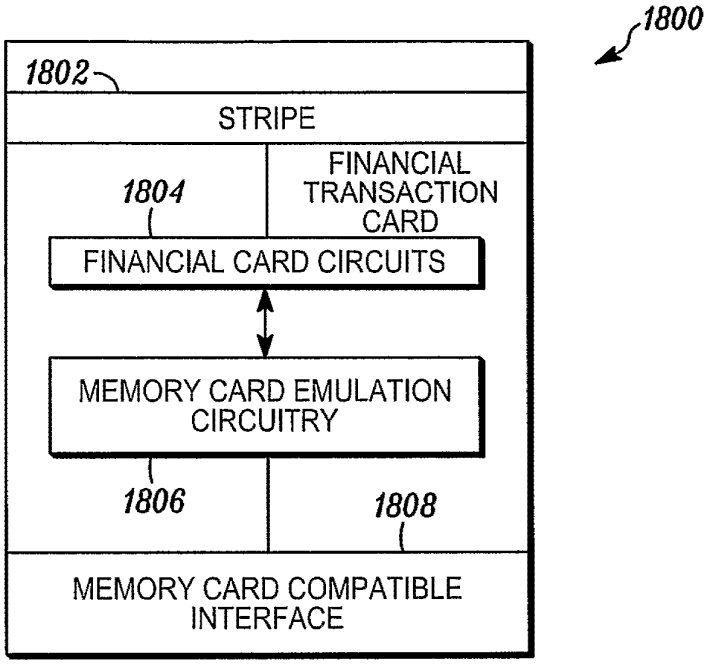

1800
1802
STRIPE
1804
FINANCIAL TRANSACTION CARD
FINANCIAL CARD CIRCUITS
MEMORY CARD EMULATION CIRCUITRY
1806
1808
MEMORY CARD COMPATIBLE INTERFACE

FIG. 18

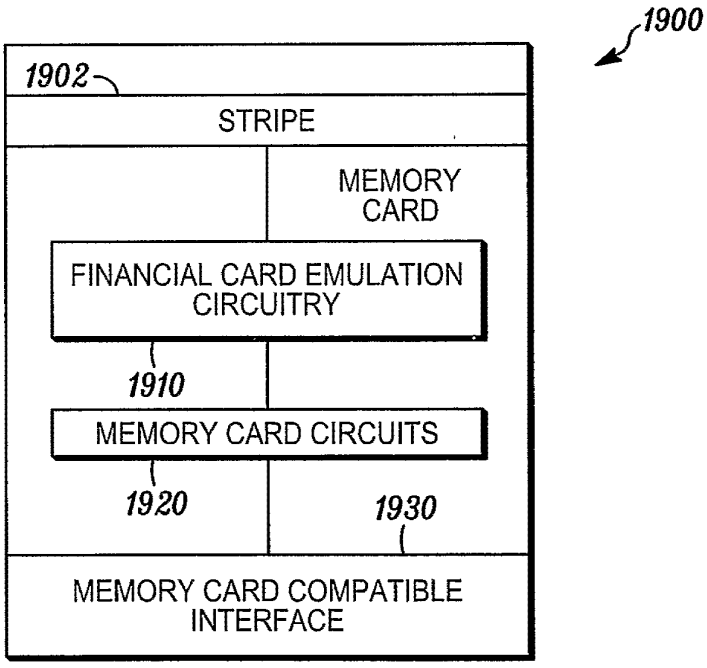

1900
1902
STRIPE
MEMORY CARD
FINANCIAL CARD EMULATION CIRCUITRY
1910
MEMORY CARD CIRCUITS
1920
1930
MEMORY CARD COMPATIBLE INTERFACE

FIG. 19

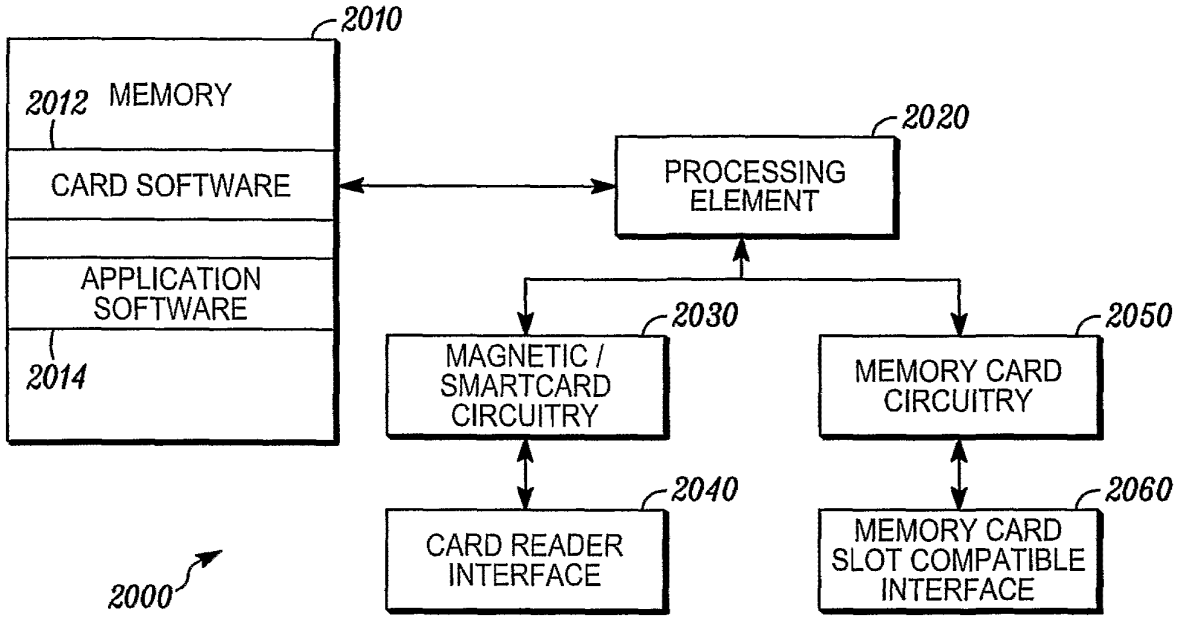

2010
2012 MEMORY
CARD SOFTWARE
APPLICATION SOFTWARE
2014
2020
PROCESSING ELEMENT
2030
MAGNETIC / SMARTCARD CIRCUITRY
2050
MEMORY CARD CIRCUITRY
2040
CARD READER INTERFACE
2060
MEMORY CARD SLOT COMPATIBLE INTERFACE
2000

FIG. 20

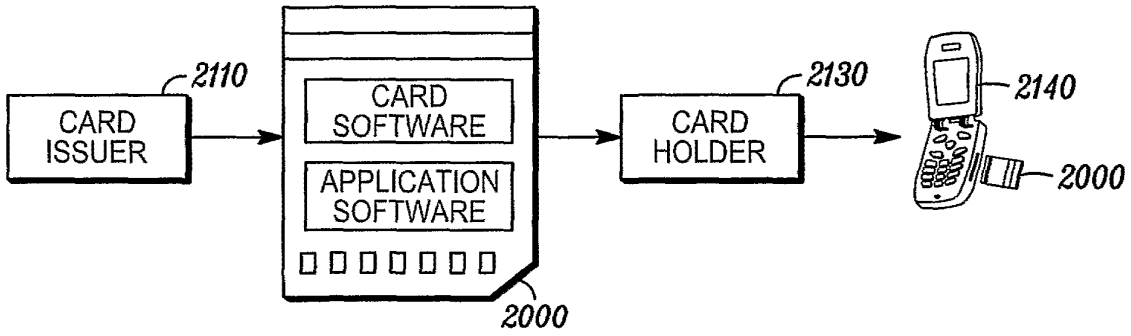

2110
CARD ISSUER
CARD SOFTWARE
APPLICATION SOFTWARE
2000
2130
CARD HOLDER
2140
2000

FIG. 21

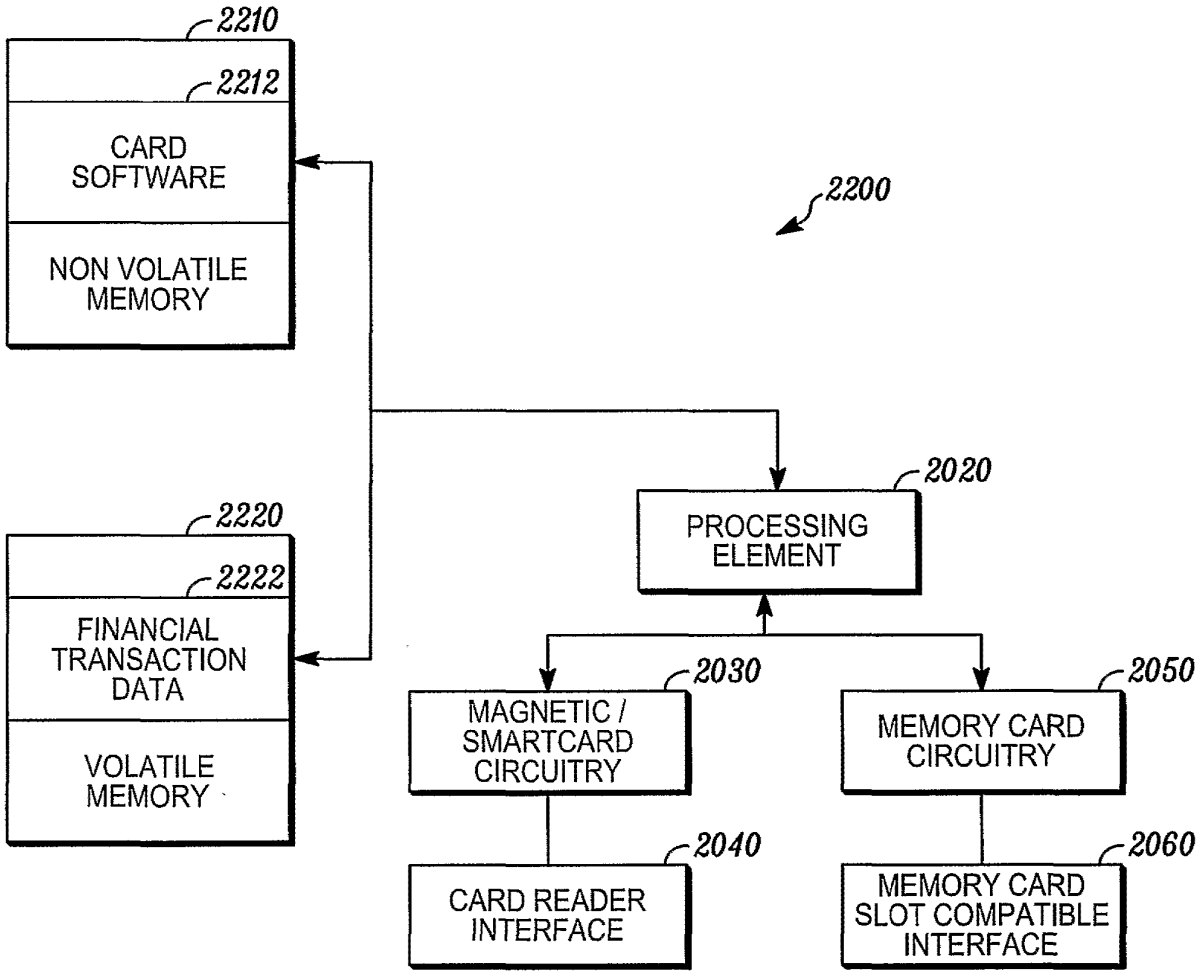

2210
2212
CARD SOFTWARE
NON VOLATILE MEMORY
2200
2020
PROCESSING ELEMENT
2220
2222
FINANCIAL TRANSACTION DATA
VOLATILE MEMORY
2030
MAGNETIC / SMARTCARD CIRCUITRY
2050
MEMORY CARD CIRCUITRY
2040
CARD READER INTERFACE
2060
MEMORY CARD SLOT COMPATIBLE INTERFACE

FIG. 22

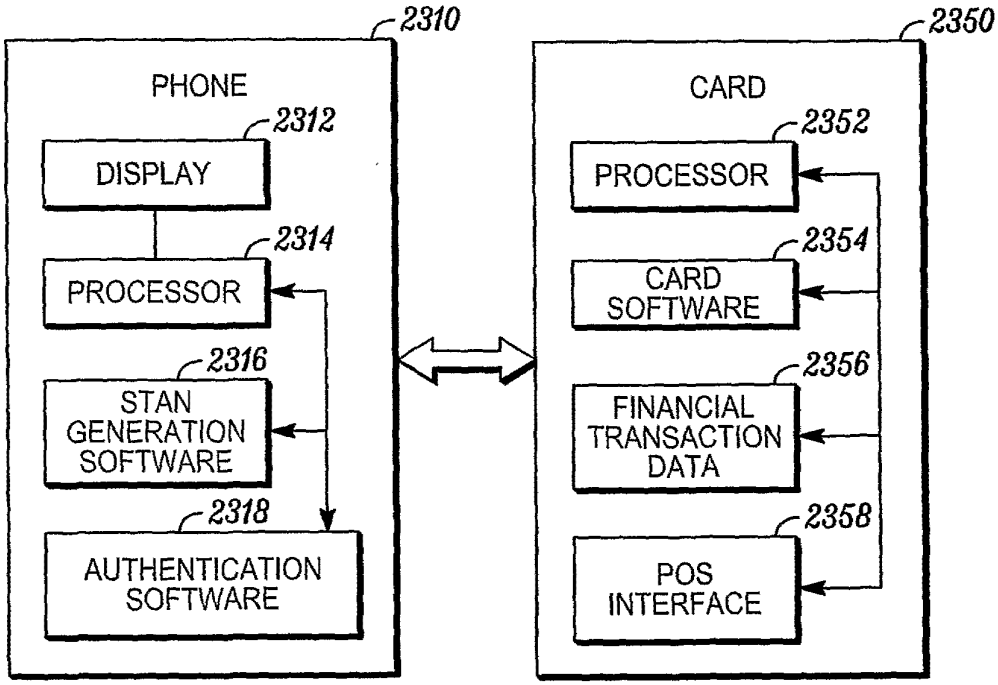

2310
PHONE
2312
DISPLAY
2314
PROCESSOR
2316
STAN GENERATION SOFTWARE
2318
AUTHENTICATION SOFTWARE
2350
CARD
2352
PROCESSOR
2354
CARD SOFTWARE
2356
FINANCIAL TRANSACTION DATA
2358
POS INTERFACE

FIG. 23

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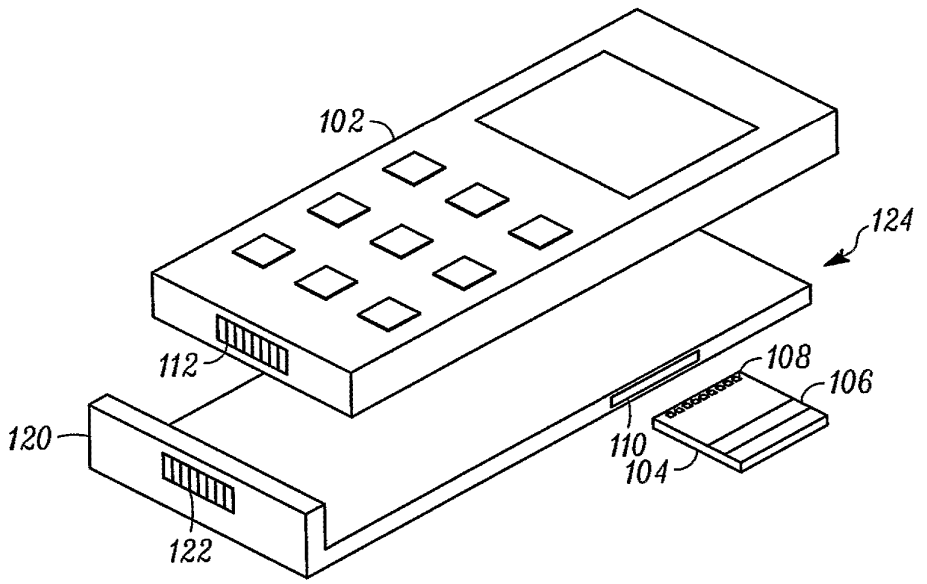
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Published:
— *with international search report*

[Continued on next page]

(54) **Title:** SLEEVE FOR ELECTRONIC TRANSACTION CARD



(57) **Abstract:** A sleeve provides communications between an electronic transaction card and an intelligent electronic device. The intelligent electronic device may be a mobile phone or other device with or without network connectivity. The electronic transaction card may have magnetic field producing circuitry compatible with magnetic card readers, smartcard circuitry, other point-of-sale interfaces, or any combination thereof.

WO 2006/108184 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

SLEEVE FOR ELECTRONIC TRANSACTION CARD

Field

The present invention relates generally to electronic devices, and more specifically to electronic devices that may perform transactions.

Background

Magnetic cards have many purposes. Examples include credit cards, debit cards, stored value cards, identification cards, access entry cards, and the like. Many of these cards have information stored in a magnetic stripe in a static manner. For example, a credit card may have a credit card number, a cardholder's name, and an issuing bank's name statically encoded in a magnetic strip. Likewise, an identification card or access entry card may have statically encoded information that identifies an individual or allows access to a controlled access area. When the card is swiped through a magnetic card reader, the information is transferred to the magnetic card reader to perform a transaction, such as a financial transaction or identification transaction.

Brief Description of the Drawings

Figures 1-4 show exploded views of an intelligent electronic device, a sleeve, and an electronic transaction card;

Figure 5 shows an intelligent electronic device, a sleeve, and an electronic transaction card;

Figure 6 shows an electronic transaction card and a card reader;

Figure 7 shows an intelligent electronic device, a sleeve an electronic transaction card, and a magnetic card reader;

Figure 8 show a sleeve for use with an electronic transaction card;

Figures 9-11 show block diagrams of sleeves;

Figures 12 and 13 show a foldable electronic transaction card;

Figures 14 and 15 show an electronic transaction card having a sliding portion;

Figure 16 shows an intelligent electronic device and an electronic transaction card; and

Figures 17 and 18 show block diagrams of electronic transaction cards.

Description of Embodiments

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, various embodiments of an invention. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described in connection with one embodiment may be implemented within other embodiments without departing from the spirit and scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the spirit and scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

Figure 1 shows an intelligent electronic device, a sleeve and an electronic transaction card. Intelligent electronic device 102 includes connector 112; sleeve 120 includes body portion 124, replicated connector 122, and add-on slot 110; and electronic transaction card 104 includes electrical contacts 108 and stripe 106.

Intelligent electronic device 102 is shown as a mobile phone in Figure 1, but this is not a limitation of the present invention. For example, intelligent electronic device 102 may be a personal digital assistant (PDA), a smartphone, a mobile

phone, a handheld computer, or any other device capable of operating as described herein.

Intelligent electronic device 102 may include a mechanism to allow intelligent electronic device 102 to communicate with a wired or wireless network. For example, intelligent electronic device 102 may include circuitry to communicate with a cellular phone network. Note that in these embodiments, intelligent electronic device 102 may or may not be a phone. For example, intelligent electronic device 102 may be a cellular telephone with an add-on slot for use with an electronic transaction card. Also for example, intelligent electronic device may be a non-telephonic device that has cellular network connectivity. Examples include personal digital assistants, and handheld devices dedicated to the use of electronic transaction cards. Further, intelligent electronic device 102 may be a non-telephonic device having wired or wireless connectivity to a network other than a cellular network, and in some embodiments, intelligent electronic device 102 may be a device without network connectivity. Examples include, but are not limited to: Blackberry devices available from Research in Motion (RIM), music players such as MP3 players, cameras, and the like.

Intelligent electronic device 102 includes connector 112. Connector 112 may be a data connector that allows intelligent electronic device 102 to communicate with other devices. For example, connector 112 may be a data connector on the base of a cellular phone or PDA that can communicate with a cradle to synchronize the cellular phone or PDA with another data repository such as a computer. Although connector 112 is shown at the base of intelligent electronic device 102, this is not a limitation of the present invention. For example, connector 112 may be on a side, back, top, or any other surface of intelligent electronic device 102.

Sleeve 120 is a sleeve that mechanically and electrically mates with intelligent electronic device 102. In some embodiments, sleeve 120 includes a mating connector (not shown) that electrically mates with connector 112 when intelligent electronic device 102 is coupled to sleeve 120. Sleeve 120 may also

include replicated connector 122. Replicated connector 122 replicates connector 112 to allow intelligent electronic device 102 to communicate with other devices while mated with sleeve 120. In some embodiments, intelligent electronic device 102 and sleeve 120 communicate wirelessly. For example, intelligent electronic device 102 and sleeve 120 may communicate using a personal area network (PAN) such as Bluetooth, a wireless area network (WAN) such as IEEE 802.11, or any other wireless communications protocol. In these embodiments, replicated connector 122 may replicate connector 112 using wireless communications between intelligent electronic device 102 and sleeve 120.

Sleeve 120 has a body portion 124 that includes a contour to mechanically accept intelligent electronic device 102. For simplicity, sleeve 120 is shown having a contour that is relatively flat to accept intelligent electronic device 102, which is also shown as relatively flat. In other embodiments, sleeve 120 has a contour that is not flat. For example, sleeve 120 may have a concave or convex contour to match the shape of a mating intelligent electronic device. Further, in some embodiments, the body of sleeve 120 may have sides that more fully envelope intelligent electronic device 102.

Sleeve 120 includes add-on slot 110. Add-on slot 110 is a slot capable of accepting electronic transaction card 104. For example, add-on slot 110 may have physical dimensions compatible with electronic transaction card 104, and may have a communications interface that operates using a protocol compatible with electronic transaction card 104. In some embodiments, electronic transaction card 104 includes an identification number that provides a relationship to sleeve 120 or intelligent electronic device 102. For example, electronic transaction card 104 may include an ID number that provides a unique pairing relationship or a non-unique pairing relationship between electronic transaction card 104 and intelligent electronic device 102, or between electronic transaction card 104 and sleeve 120, or between electronic transaction card 104 and both sleeve 120 and intelligent electronic device 102.

In some embodiments of the present invention, add-on slot 110 is a memory card slot designed to accept and communicate with memory cards. Add-on slot 110 slot may be a proprietary card slot designed to accept memory cards that adhere to a proprietary communications protocol. Add-on slot 110 may also be compatible with an industry standard communications protocol, or may be compatible with a widely accepted communications protocol that is not necessarily formally documented as an industry standard. Examples include slots that are compatible with the Multimedia Memory Card (MMC) protocol, Memory Stick DUO protocol, secure digital (SD) protocol, and Smart Media protocol. The foregoing list is meant to be exemplary, and not exhaustive. Add-on slot 110 may be compatible with many memory card slot protocols other than those explicitly listed above without departing from the scope of the invention.

In some embodiments of the present invention, add-on slot 110 is compatible with electronic transaction cards that are substantially the same size as a credit card. In these embodiments, an electronic transaction card may have a width and a length, and add-on slot 110 may accept an edge of the card that has a dimension equal to either the width or the length. Further, in some embodiments, add-on slot may be compatible with a folded electronic transaction card, embodiments of which are described further below.

Electronic transaction card 104 includes electrical contacts 108 and stripe 106. Electrical contacts 108 are contacts that provide a communications interface to communicate with add-on slot 110. For example, electrical contacts 108 may provide connectivity compliant with a communications protocol for memory cards. Also for example, electrical contacts 108 may provide connectivity that is not compliant with a communications protocol for memory cards. The electrical contacts may be on the back side of electronic transaction card 104, recessed on an edge of electronic transaction card 104, or on the front side of electronic transaction card 104. In some embodiments, electronic transaction card 104 includes a "contactless" interface to add-on slot 110. For example, electronic transaction card 104 may include an interface to add-on slot 110 that communicates using electric or

magnetic fields, infrared (IR) light, or any other suitable communications mechanism.

Stripe 106 represents an area on an external face of electronic transaction card 104 at which one ore more time-varying magnetic fields emanate. For example, one or more time-varying magnetic fields may emanate from the location of stripe 106 to communicate with a magnetic card reader. In some embodiments, the time-varying magnetic field may emulate the time-varying magnetic field produced when a typical magnetic card is swiped through a magnetic card reader. For example, a time-varying magnetic field produced at stripe 106 may emulate the swipe of a credit card, a debit card, or any other card having a magnetic stripe compatible with a magnetic card reader.

In some embodiments of the present invention, stripe 106 may be a visible stripe on electronic transaction card 104. When stripe 106 is visible, it may be used to indicate the location at which the time-varying magnetic field will emanate. In other embodiments of the present invention, stripe 106 may not be visible. For example, circuitry may be included within electronic transaction card 106 to produce the time-varying magnetic field and no visible indication may be present on an external face of electronic transaction card 104.

Stripes may be compatible with one or more standards. A stripe may be compatible with a standard by being in compliance with the standard or by being partially in compliance with the standard. For example, stripe 106 may be compatible with an American National Standards Institute (ANSI) magnetic stripe standard, or an International Organization for Standardization (ISO) magnetic stripe standard. In addition, in some embodiments, a stripe may emulate more than one magnetic track, and the emulated tracks may or may not be offset from the location specified in a standard. For example, one or more wires may be utilized to generate time-varying magnetic fields compatible with a standard, and the wires may be located at or near stripe 106 in a location different than the magnetic track offset described in an associated standard.

In operation, intelligent electronic device 102 may communicate with electronic transaction card 104 through sleeve 120, and also may program electronic transaction card 104 for use in a transaction involving stripe 106. For example, intelligent electronic device 102 may program electronic transaction card 104 to operate as a credit card, a debit card, or the like. Electronic transaction card 104 may then be used with a magnetic stripe or smartcard based merchant point-of-sale terminal to effect a transaction. Also for example, intelligent electronic device 102 may program electronic transaction card 104 to operate in any other environment where stripe 106 may be beneficially utilized with a magnetic card reader. In some embodiments, communications over a network may play a role in the transaction. For example, intelligent electronic device 102 may receive authorization for the transaction over a network. Also for example, intelligent electronic device 102 may program electronic transaction card 104 to perform a transaction, and then report the transaction to an entity using the network.

Electronic transaction card 104 may be utilized in financial transactions. For example, electronic transaction card 104 may be programmed to operate as a credit card or a stored value card. In these embodiments, electronic transaction card 104 may be programmed to emit one or more time-varying magnetic fields to emulate the swiping of a credit card or stored value card. In some of these embodiments, electronic transaction card 104 may use one number repeatedly, or may use a different number for each transaction. For example, electronic transaction card 104 may be programmed to have one number, similar to how a credit card uses the same number repeatedly. Also for example, electronic transaction card 104 may be programmed to use a different number for each transaction. These numbers are referred to herein as "single transaction account numbers" or "STANs."

Single transaction account numbers may be generated by the card issuer or locally by either an intelligent electronic device or an electronic transaction card. Generation of STANs may be accomplished in any of several ways. For example, when an electronic transaction card is issued, the cardholder may receive several pre-assigned single-use transaction numbers. The numbers may also have a pre-

specified sequence. In some embodiments, this sequence may be known only to the issuing bank and the cardholder's intelligent electronic device and/or electronic transaction card. A card issuing bank may authorize payments based on the expected sequence of account numbers, and if out-of-sequence account numbers are used, then the issuing bank may consider that transaction as a potentially fraudulent transaction. The issuing bank may also use this feature to track the merchant involved in the potentially fraudulent transaction.

According to another example, a pre-assigned sequence of STANs may be reset to the original starting number on the list depending on user input or other triggers. In addition, the list of numbers may be periodically downloaded via a cellular phone network or other network connectivity.

Figure 2 shows an exploded view of an intelligent electronic device, a sleeve, and an electronic transaction card. Intelligent electronic device 202 is similar to intelligent electronic device 102 (Figure 1), with the exception of connector 212. Further, sleeve 220 is similar to sleeve 120 (Figure 1), with the exception of mating connector 222.

Intelligent electronic device 202 includes connector 212 which is in the form of an add-on slot that receives mating connector 222 of sleeve 220. In some embodiments, connector 212 is a memory card slot as described above with reference to add-on slot 110 (Figure 1). In other embodiments, connector 212 is a slot other than a memory card slot.

Mating connector 222 of sleeve 220 includes contacts 224 to communicate with intelligent electronic device 202. In some embodiments, connector 222 is compatible with a memory card interface, and is received by a memory card compatible add-on slot shown as connector 212.

Add-on slot 210 may or may not be a replicated connector. For example, in embodiments where both connector 212 and add-on slot 210 are memory card slots, add-on slot 210 may replicate connector 212. In these embodiments, sleeve 220 may provide general memory card connectivity for intelligent electronic device 202. Further, in some embodiments, sleeve 220 includes multiple replicated connectors.

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For example, add-on slot 210 may be one of two or more add-on slots that provide connectivity for an electronic transaction card as well as other peripheral devices.

Electronic transaction card 204 includes electrical contacts 208 and 206. Electrical contacts 208 are similar to electrical contacts 108 (Figure 1). For example, electrical contacts 208 are compatible with add-on slot 210 of sleeve 220. Electrical contacts 206 are arranged to provide the communications interface to a smartcard reader.

In some embodiments, electronic transaction card 204 includes a smartcard interface as well as a stripe to produce one or more time-varying magnetic fields. For example, the backside of electronic transaction card 204 may include a stripe. Any of the various electronic transaction cards described herein may include a stripe, a smartcard interface, or a combination thereof.

Figure 3 shows an intelligent electronic device, a sleeve and an electronic transaction card. Intelligent electronic device 102 is described above with reference to Figure 1. As shown in Figure 3, intelligent electronic device 102 communicates with sleeve 320 over a wireless link 310. Wireless link 310 may be any type of wireless link, including a personal area network (PAN) such as Bluetooth. Sleeve 320 is shown having electronic transaction card 104 inserted into an add-on slot. Sleeve 320 may also have a replicated connector (not shown).

Figure 4 shows an intelligent electronic device, a sleeve and an electronic transaction card. As in the embodiments represented by Figure 1, intelligent electronic device 102 mates to sleeve 420 using connector 112. Sleeve 420 communicates with electronic transaction card 404 using wireless link 410. Wireless link 410 may be any type of wireless link, including a personal area network (PAN) such as Bluetooth. In embodiments represented by Figure 4, sleeve 420 and electronic transaction card 404 both include wireless interfaces.

Figure 5 shows an intelligent electronic device, a sleeve, and an electronic transaction card. Intelligent electronic device 502 may be any intelligent electronic device described herein. For example, intelligent electronic device 502 may include a connector or a wireless interface to communicate with sleeve 520. Sleeve 520

may be any sleeve described herein. For example, sleeve 520 may include a mating connector or a wireless interface to communicate with intelligent electronic device 502. Further, sleeve 520 may include a replicated connector. The replicated connector may be connector 522 or may be add-on slot 510 into which electronic transaction card 504 is shown inserted.

Electronic transaction card 504 is shown protruding from sleeve 520, but this is not a limitation of the present invention. For example, in some embodiments, electronic transaction card 504 is flush with sleeve 520 when inserted. Further, in some embodiments, electronic transaction card 504 is recessed within sleeve 520 when inserted.

Figure 6 shows an electronic transaction card and a card reader. Electronic transaction card 610 is a card having a stripe compatible with a magnetic card reader. For example, electronic transaction card 610 may be electronic transaction card 104 (Figure 1), electronic transaction card 204 (Figure 2), electronic transaction card 404 (Figure 4), electronic transaction card 504 (Figure 5), or any other electronic transaction card described herein. Magnetic card reader 620 is a card reader compatible with magnetic cards. For example, magnetic card reader 620 may operate as part of a merchant point-of-sale terminal, an access control device, or the like. When a magnetic card is swiped through magnetic card reader 620, one or more time-varying magnetic fields are produced relative to the location of a magnetic read head (not shown) in magnetic card reader 620.

In the operation depicted in Figure 6, electronic transaction card 610 is swiped through magnetic card reader 620. During the swiping operation, electronic transaction card 610 produces one or more time-varying magnetic fields to emulate the swiping of a magnetic card. For example, a swipe sensor within electronic transaction card 610 may detect the swiping action depicted in Figure 6, and a magnetic field producing circuit may generate one or more time-varying magnetic fields as electronic transaction card 610 passes by a magnetic read head in magnetic card reader 620.

Figure 7 shows an intelligent electronic device, a sleeve an electronic transaction card, and a magnetic card reader. Electronic transaction card 710 is shown being swiped through magnetic card reader 730 while attached to sleeve 720. Further, intelligent electronic device 702 is shown mated with sleeve 720. The operation depicted in Figure 7 represents a transaction occurring while electronic transaction card 710 is coupled to an add-on slot of sleeve 720.

Figure 8 show a sleeve for use with an electronic transaction card. Sleeve 800 includes a body with contour 850 to receive an intelligent electronic device. Sleeve 800 also includes mating connector 820 to communicate with an intelligent electronic device, and an add-on slot 810 to receive an electronic transaction card. Sleeve 800 also includes battery 830 and charger port 840.

In operation, an intelligent electronic device may be mechanically mated with contour 850, and may be electrically mated with mating connector 820. Add-on slot 810 provides communications with an electronic transaction card, and may also be a replicated connector as described above. Battery 830 provides power to electronics within sleeve 800, and charger port 840 is compatible with a charger to allow sleeve 800 to be "plugged in" to charge battery 830.

The particular mechanical configuration of sleeve 800 is not a limitation of the present invention. For example, battery 830 may be located differently or may be a different shape. Further, mating connector 820 may be located differently or may be a different shape.

Figure 9 shows a block diagram of a sleeve. Sleeve 900 includes mating connector 910, intelligent electronic device (IED) interface 920, replicated connector 930, data routing circuitry 940, electronic transaction card interface 950, add-on slot 960, and power source 970. Sleeve 800 may include more than shown in Figure 9, and nothing in Figure 9 is to be considered essential to a sleeve as described herein.

Mating connector 910 provides an electrical connection to a connector on an intelligent electronic device. For example, mating connector 910 may be a connector to mate with connector 112 (Figure 1), connector 212 (Figure 2), 820

transaction card interface 950, add-on slot 960, and power source 970, which are described above with reference to Figure 9. Sleeve 1000 also includes antenna 1020, and wireless interface 1010. Wireless interface 1010 is coupled to IED interface 920 to provide communication between sleeve 1000 and an intelligent electronic device. Accordingly, sleeve 1000 may be a sleeve with wireless capabilities, such as sleeve 320 (Figure 3). Antenna 1020 may be any type of element capable of radiating energy and/or capturing energy.

Figure 11 shows a block diagram of a sleeve. Sleeve 1100 includes mating connector 910, IED interface 920, replicated connector 930, data routing circuitry 940, electronic transaction card interface 950, and power source 970, which are described above with reference to Figure 9. Sleeve 1100 also includes antenna 1120, and wireless interface 1110. Wireless interface 1110 is coupled to electronic transaction card interface 960 to provide communication between sleeve 1100 and an electronic transaction card. Accordingly, sleeve 1100 may be a sleeve with wireless capabilities, such as sleeve 420 (Figure 4). Antenna 1120 may be any type of element capable of radiating energy.

Figures 12 and 13 show a folding electronic transaction card. Figure 12 shows electronic transaction card 1200 partially folded. Electronic transaction card 1200 may completely unfold to become flat. In some embodiments, electronic transaction card 120 unfolds to become the size of a standard credit card. Electronic transaction card 1200 may have electrical contacts or a wireless interface to communicate with a sleeve or an intelligent electronic device. Figure 13 shows electronic transaction card 1200 folded. In some embodiments, electronic transaction card 1200 fits into an add-on slot of a sleeve when folded, and may be used either folded or unfolded in a transaction.

Figures 14 and 15 show an electronic transaction card having a sliding portion. Figure 15 shows electronic transaction card 1400 with sliding portion 1410 "slid out," and Figure 14 shows sliding portion 1410 "slid in." Electronic transaction card 1400 provides a variable form factor that allows the card to be

smaller when used in an existing add-on slot, and larger for ease of use in a transaction.

Figures 12-15 show two different variable form factors for electronic transaction cards, but the invention is not so limited. For example, an electronic transaction card may have a pivot point, and a "larger" card may be created by rotating a portion of a card relative to another portion. Various embodiments of the present invention contemplate any variable form factor that allows a card to be a reduced size to be accepted by a slot, and an increased size for use in a transaction. Further, any variable form factor electronic transaction card may include a stripe, a smartcard interface, or both, on any portion of the card, and in any orientation without departing from the scope of the present invention.

Figure 16 shows an intelligent electronic device and an electronic transaction card. Intelligent electronic device 102 is described above with reference to previous figures. Electronic transaction card 1604 includes stripe 1606 and mating connector 1608. In operation, mating connector 1608 mates with connector 112 on intelligent electronic device 102. Electronic transaction card may then be removed from intelligent electronic device 102 and used in a magnetic card reader as shown in Figure 6. In some embodiments, electronic transaction card 1604 includes a smartcard interface in lieu of, or in addition to, stripe 1606. Electronic transaction card 1604 may or may not have a hole for a key ring as shown in Figure 16.

Although electronic transaction card 1604 is shown with mating connector 1608, this is not a limitation of the present invention. For example, electronic transaction card 1604 may include a contactless interface, such as a wireless interface, to communicate with intelligent electronic device 102.

Figure 17 shows a block diagram of an electronic transaction card. Electronic transaction card 1700 is an electronic transaction card capable of communicating with a sleeve, and capable of communicating with a magnetic card reader. For example, electronic transaction card 1700 may be any of the electronic transaction card embodiments described herein that includes a stripe.

Electronic transaction card 1700 includes intelligent electronic device (IED) interface 1704, nonvolatile memory 1706, processing device 1708, volatile memory 1710, magnetic field producing circuits 1712, swipe sensor 1714, and stripe 1720. IED interface 1704 is coupled to provide a communications interface between electronic transaction card 1700 and a sleeve or an intelligent electronic device. For example, IED interface 304 may be an interface compatible with an add-on slot, or may be a wireless interface that allows electronic transaction card 1700 to communicate wirelessly.

Magnetic field producing circuit 1712 includes one or more circuits to produce time-varying magnetic fields at or near the location of stripe 1720. For example, one or more current carrying conductors may be excited to produce a magnetic field, and the current may be varied in amplitude and reversed in polarity to cause the magnetic field to be time-varying. In some embodiments, the number of magnetic field producing circuits corresponds to the number of tracks being emulated for stripe 1720. For example, stripe 1720 may emulate two, three, four, or more magnetic tracks on a magnetic card such as a credit card. In these embodiments, electronic transaction card 1700 may include two, three, four, or more magnetic field producing circuits 1712. Magnetic field producing circuits 1712 may also include circuits to allow control of the time-varying magnetic field. For example, magnetic field producing circuits 1712 may include voltage drivers, current drivers, registers to hold digital data, sequential circuits to translate the digital data to magnetic fields, and the like.

Swipe sensor 1714 senses when electronic transaction card 1700 has been swiped in a magnetic card reader, and provides a swipe indication to processing device 1708. The swipe sensor may be a mechanical switch, an electronic switch, or any other type of suitable switch. For example, a mechanical switch may get pressed when electronic transaction card 1700 is swiped. Also for example, an electrical sensor may include two or more contacts (not shown) that get shorted when swiped past a metal head within a card reader. Further, a Hall effect sensor or

light-based sensor may be utilized. The present invention is not limited by the type of swipe sensor utilized. In some embodiments, swipe sensor 1714 is omitted.

Processing device 1708 represents a processor capable of communicating with the other blocks shown in electronic transaction card 1700. For example, processing device 1708 may be a microprocessor, a digital signal processor (DSP), a microcontroller, or the like. Further, processing device 1708 may be formed from state machines or other sequential logic. In operation, processing device 1708 may read instructions from volatile memory 1710 and/or nonvolatile memory 1706 and perform actions in response thereto. For example, processing device 1708 may execute program instructions that influence communications between electronic transaction card 1700 and an intelligent electronic device, or between electronic transaction card 1700 and a magnetic card reader.

Volatile memory 1710 represents memory that may lose its state when power is removed from electronic transaction card 1700. For example, volatile memory 1710 may be static random access memory (SRAM). Volatile memory 1708 may be utilized by processing device 1708 when executing programs. For example, a program may be copied into volatile memory 1708 prior to execution. Also for example, processing device 1708 may use volatile memory 1708 to store data during the execution of a program.

Nonvolatile memory 1706 represents memory that does not lose its state when power is removed from electronic transaction card 1700. Nonvolatile memory 1706 may be any suitable type of memory such as Flash memory with floating gate transistor memory cells. Examples include NOR Flash memory, NAND Flash memory, and multibit/cell Flash memory.

Nonvolatile memory 1706 may hold program instructions that are executable by processing device 1708. For example, prior to being sold, a manufacturer or distributor may program nonvolatile memory 1706 with program information to influence the operation of electronic transaction card 1700. Also for example, an intelligent electronic device or sleeve may provide program information to electronic transaction card 1700 through IED interface 1704.

Nonvolatile memory 1706 may also hold program instructions that are executable by a processing device other than processing device 1708. For example, a manufacturer, distributor, reseller, or other participant in the chain of commerce may program nonvolatile memory 1706 with program information to be transferred to an intelligent electronic device. Information to be transferred may include device drivers, application software, or the like.

Electronic transaction card 1700 may include one or more power sources (not shown). For example, electronic transaction card 1700 may include a battery or a capacitor such as a supercapacitor. In some embodiments, a rechargeable battery may be included. The rechargeable battery may accept a charge from an add-on slot in an intelligent electronic device. In some embodiments, a capacitor may accept a charge from an intelligent electronic device. The capacitor may provide power to electronic transaction card 1700 for enough time to perform a transaction. Further, the capacitor may be sized to ensure that a transaction may only be performed during a limited time period after removing the electronic transaction card from an add-on slot, thereby ensuring that a stolen card may not be used repeatedly without the cardholder's consent. Also in some embodiments, electronic transaction card 1700 may be programmed to go dormant if a transaction is not performed within a limited time period after removing the card from an intelligent electronic device.

Electronic transaction card 1700 may include one or more integrated circuits. For example, processing device 1708 may be on one integrated circuit die, and the memories may be on another integrated circuit die. In some embodiments, all active devices are included on a single integrated circuit die. In some embodiments, various integrated circuit dice are mounted on a common substrate to provide a high level of integration using separate dice. Any amount of circuit integration may be practiced without departing from the scope of the present invention.

Figure 18 shows a block diagram of an electronic transaction card. Electronic transaction card 1800 includes IED interface 1704, nonvolatile memory 1706, processing device 1708, volatile memory 1710, and smartcard interface 1810.

Electronic transaction card 1800 is similar to electronic transaction card 1700 (Figure 17), with the exception of smartcard interface 1810. Smartcard interface 1810 allows electronic transaction card 1800 to be used in transactions with a smartcard reader.

Electronic transaction cards 1700 and 1800 may have any of the physical forms described herein. For example, either card may be compatible with a memory card, a credit card, a folding card, or any combination.

Although the present invention has been described in conjunction with certain embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art readily understand. Such modifications and variations are considered to be within the scope of the invention and the appended claims.

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What is claimed is:

1. An apparatus comprising:
a body portion having a contour to receive an intelligent electronic device;
a first interface to provide communication with the intelligent electronic device; and
a second interface to provide communication with an electronic transaction card.

2. The apparatus of claim 1 wherein the first interface comprises a circuit to communicate with an add-on slot in the intelligent electronic device.

3. The apparatus of claim 2 wherein the add-on slot comprises a memory card slot.

4. The apparatus of claim 1 wherein the first interface comprises a wireless interface.

5. The apparatus of claim 1 wherein the first interface includes contacts to communicate with a data connector on the intelligent electronic device.

6. The apparatus of claim 5 further comprising a replicated data connector to replicate the data connector on the intelligent electronic device.

7. The apparatus of claim 1 wherein the contour is shaped to receive a cellular phone as the intelligent electronic device.

8. The apparatus of claim 1 wherein the contour is shaped to receive a personal digital assistant as the intelligent electronic device.

9. A sleeve to provide communications between a handheld intelligent electronic device and an electronic transaction card, the sleeve comprising:
an add-on slot to receive the electronic transaction card; and
an interface to communicate with the handheld intelligent electronic device.

10. The sleeve of claim 9 wherein the interface comprises a mating connector to couple to a connector on the handheld intelligent electronic device.

11. The sleeve of claim 10 wherein the sleeve further includes a replicated connector to replicate the connector on the handheld intelligent electronic device.

12. The sleeve of claim 9 wherein the add-on slot comprises a memory card slot.

13. The sleeve of claim 9 wherein the interface comprises a wireless interface.

14. The sleeve of claim 9 further comprising a battery.

15. An apparatus comprising:
means for communicating with an intelligent electronic device;
means for receiving an electronic transaction card; and
means for communicating with the electronic transaction card.

16. The apparatus of claim 15 wherein the means for receiving an electronic transaction card comprises an add-on slot.

17. The apparatus of claim 15 wherein the means for communicating with the electronic transaction card comprises a memory card compatible interface.

18. The apparatus of claim 15 wherein means for communicating with an intelligent electronic device comprises a mating connector to mate with a connector on the intelligent electronic device.

19. The apparatus of claim 18 further comprising a replicated connector to replicate the connector on the intelligent electronic device.

20. A transaction system comprising:

a cellular phone receiving portion having a shape compatible with a cellular phone and having an interface to communicate with the cellular phone; and

a stripe to communicate with a magnetic card reader.

21. The transaction system of claim 20 wherein the transaction system includes an electronic transaction card upon which the stripe is located.

22. The transaction system of claim 21 wherein the transaction system includes a sleeve upon which the cellular phone receiving portion is located.

23. The transaction system of claim 22 wherein the sleeve includes an add-on slot to receive the electronic transaction card.

24. The transaction system of claim 20 wherein the electronic transaction card includes a foldable portion to reduce the size of the electronic transaction card when folded.

25. The transaction system of claim 20 further comprising circuitry to produce a time-varying magnetic field in a vicinity of the stripe.

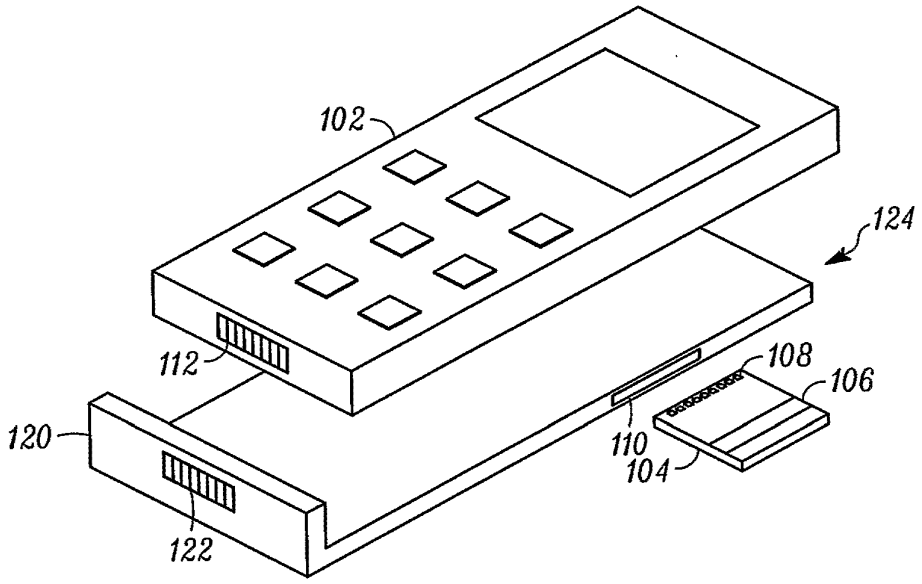


FIG. 1

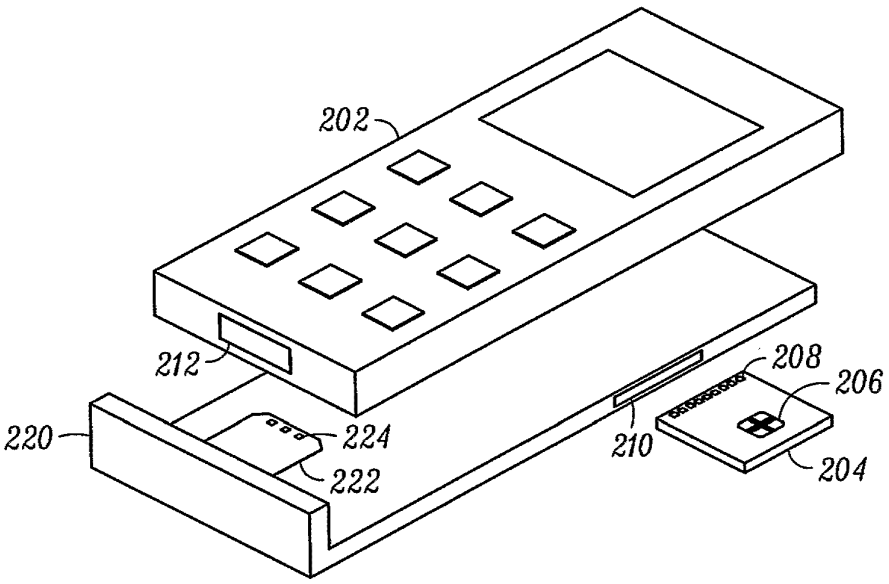


FIG. 2

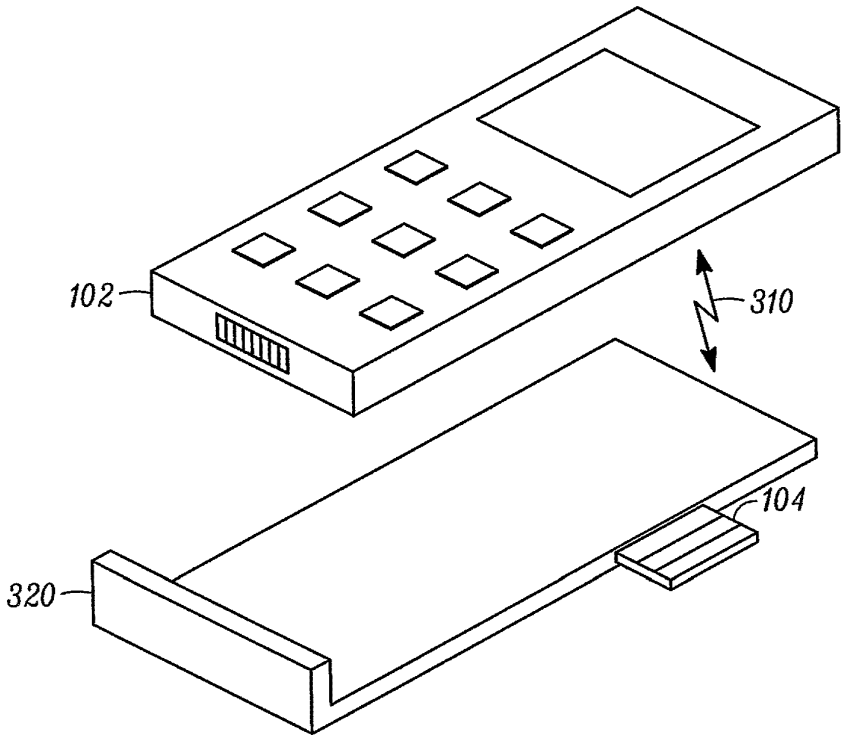


FIG. 3

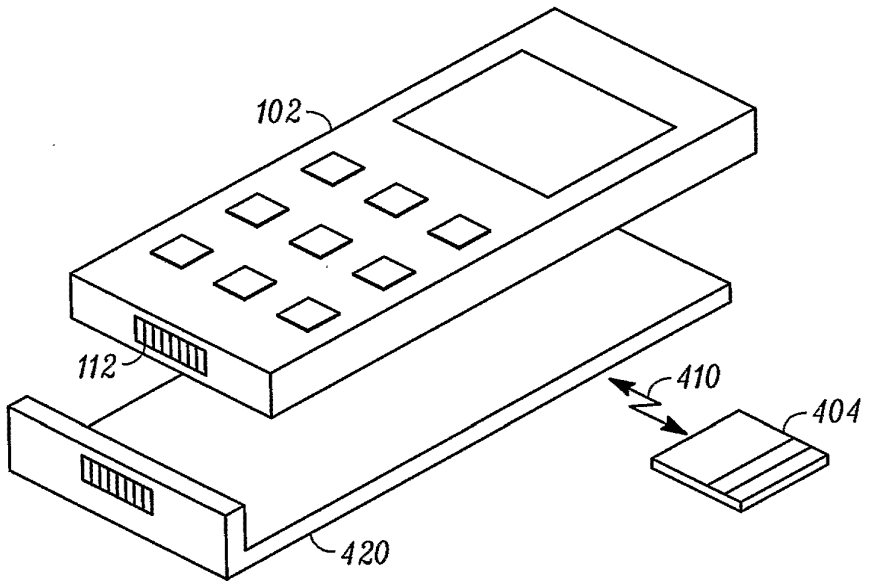


FIG. 4

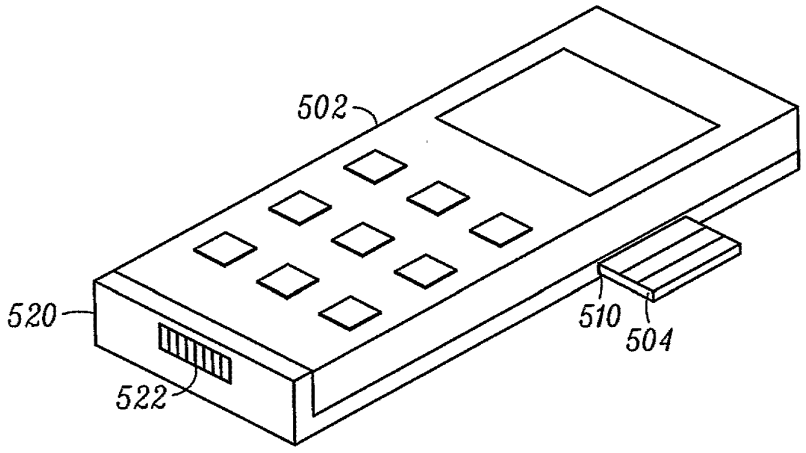


FIG. 5

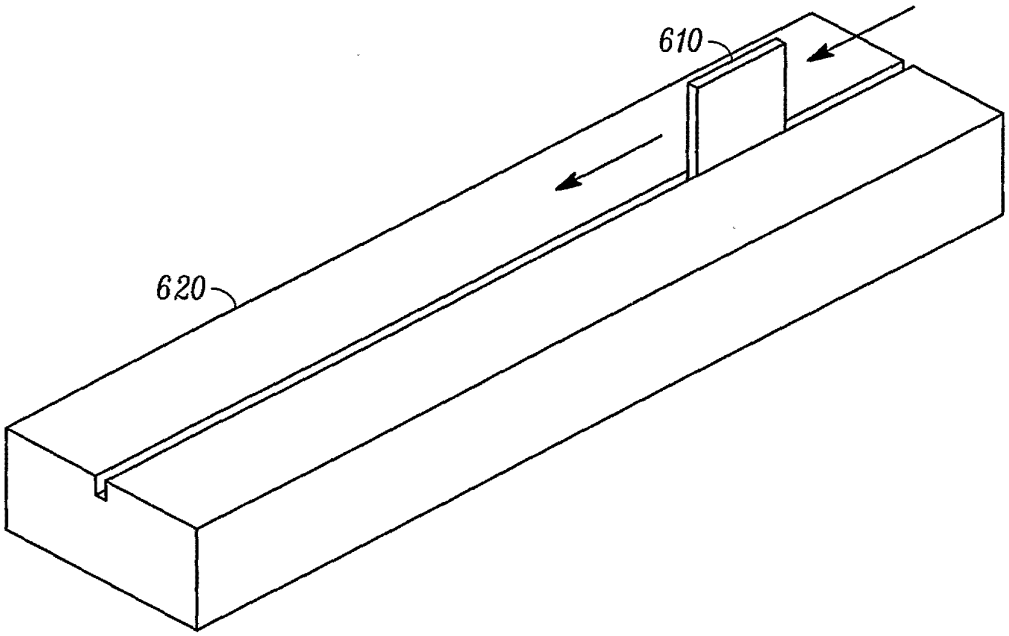


FIG. 6

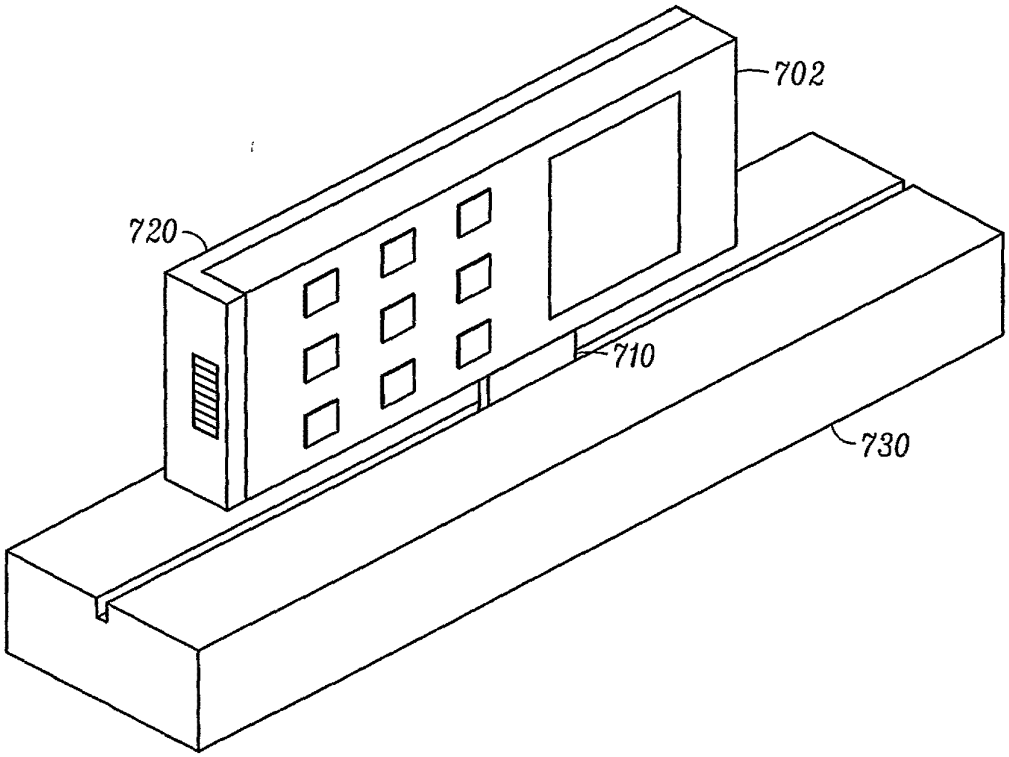


FIG. 7

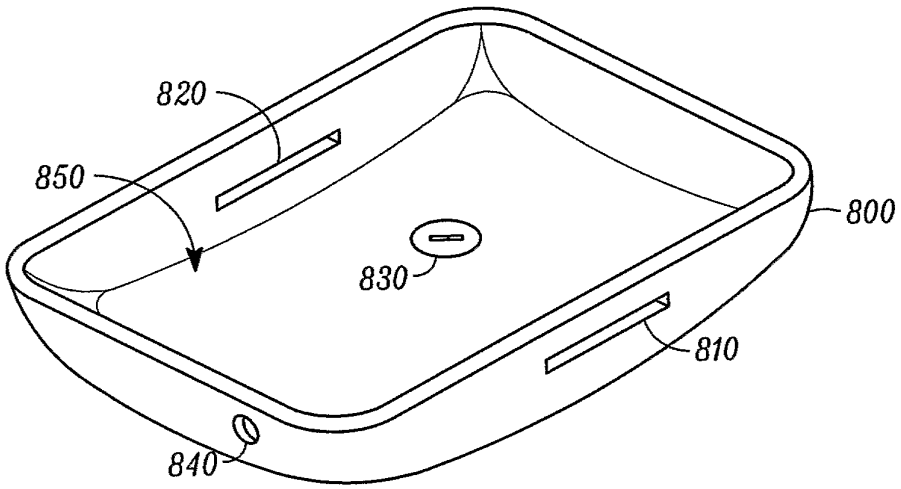


FIG. 8

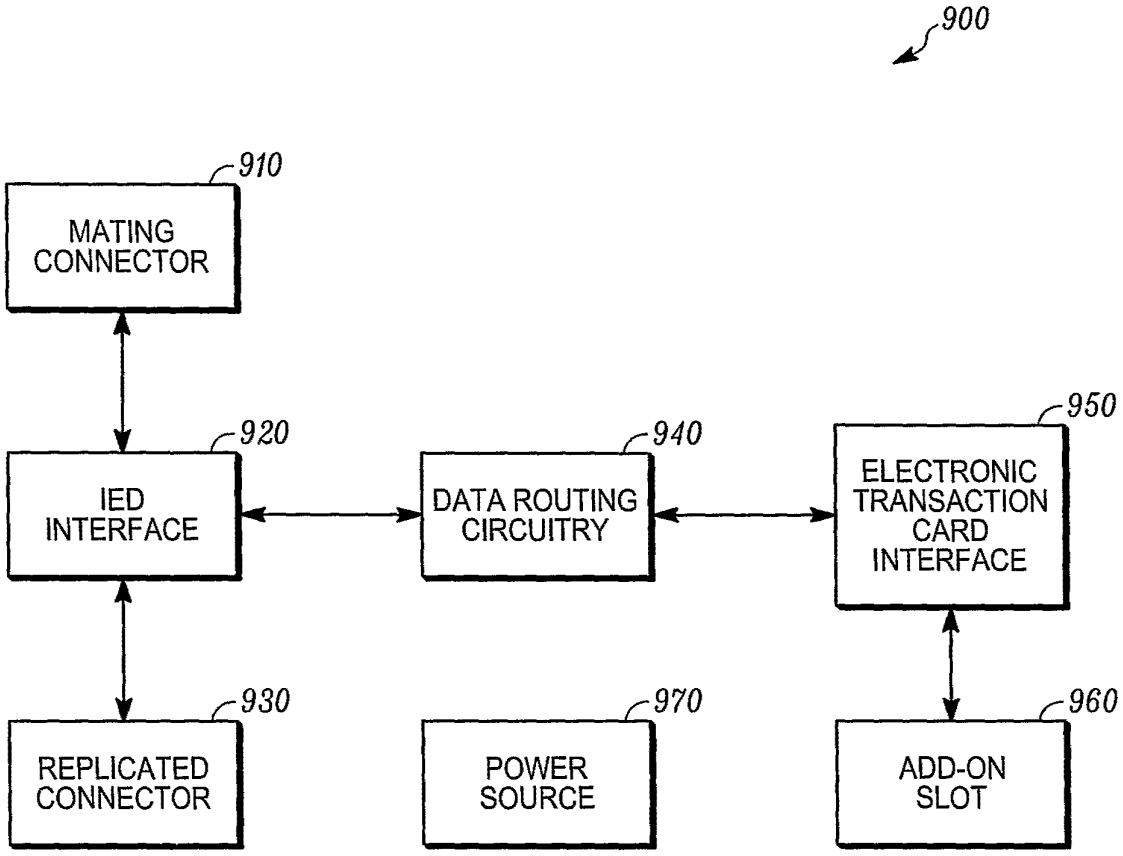

900
910
MATING CONNECTOR
920
IED INTERFACE
940
DATA ROUTING CIRCUITRY
950
ELECTRONIC TRANSACTION CARD INTERFACE
930
REPLICATED CONNECTOR
970
POWER SOURCE
960
ADD-ON SLOT

FIG. 9

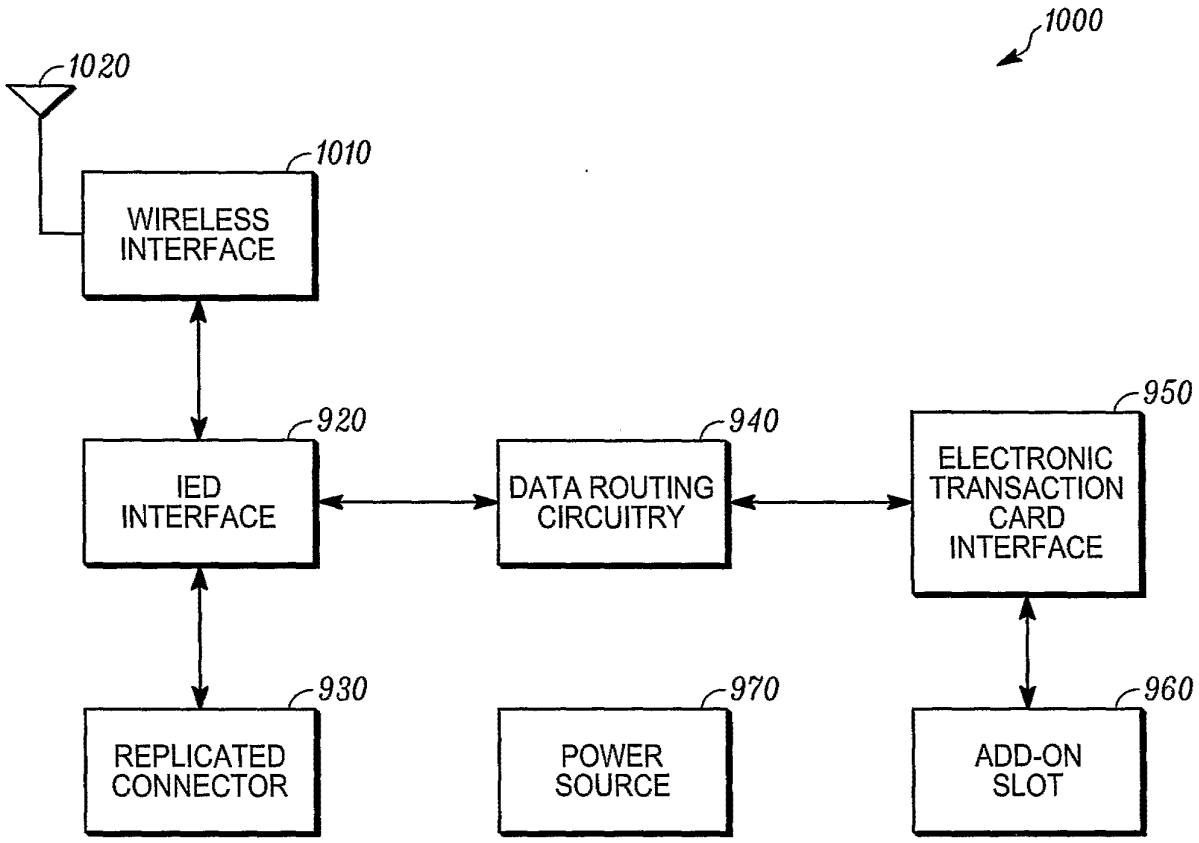

1000
1020
1010
WIRELESS INTERFACE
920
IED INTERFACE
940
DATA ROUTING CIRCUITRY
950
ELECTRONIC TRANSACTION CARD INTERFACE
930
REPLICATED CONNECTOR
970
POWER SOURCE
960
ADD-ON SLOT

FIG. 10

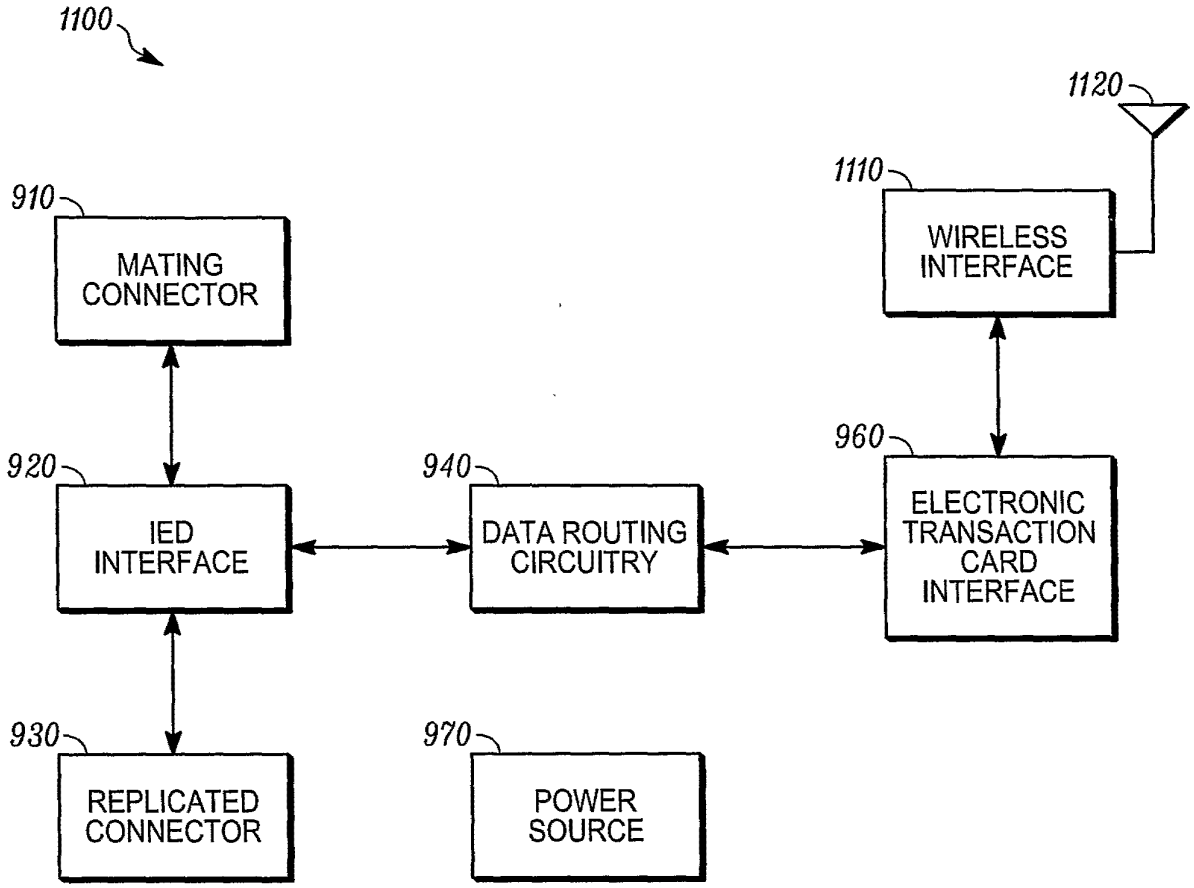

1100
1120
1110
WIRELESS INTERFACE
910
MATING CONNECTOR
960
ELECTRONIC TRANSACTION CARD INTERFACE
920
IED INTERFACE
940
DATA ROUTING CIRCUITRY
930
REPLICATED CONNECTOR
970
POWER SOURCE

FIG. 11

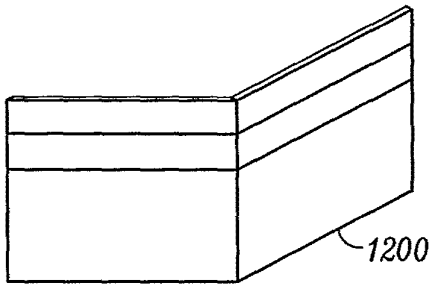


FIG. 12

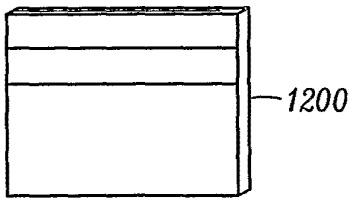


FIG. 13

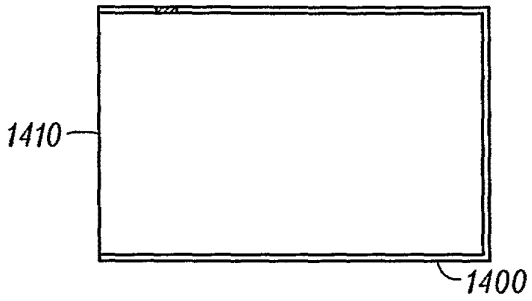


FIG. 14

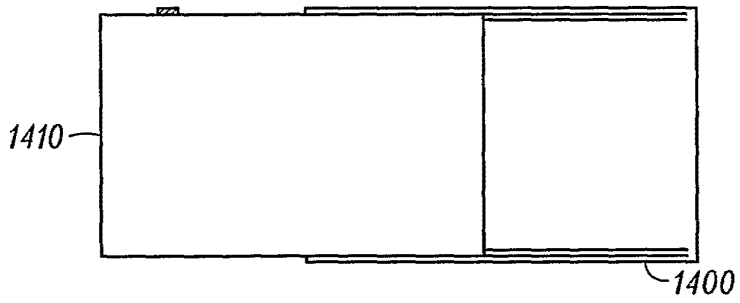


FIG. 15

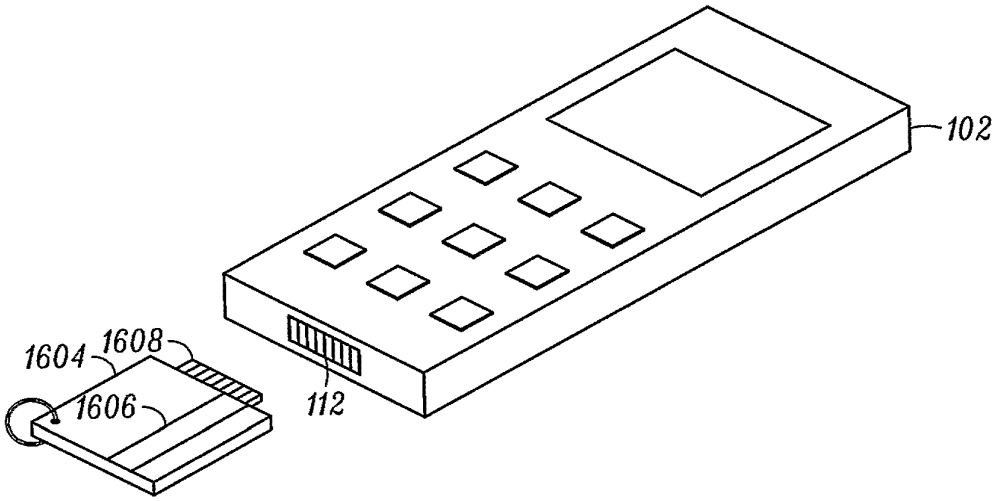


FIG. 16

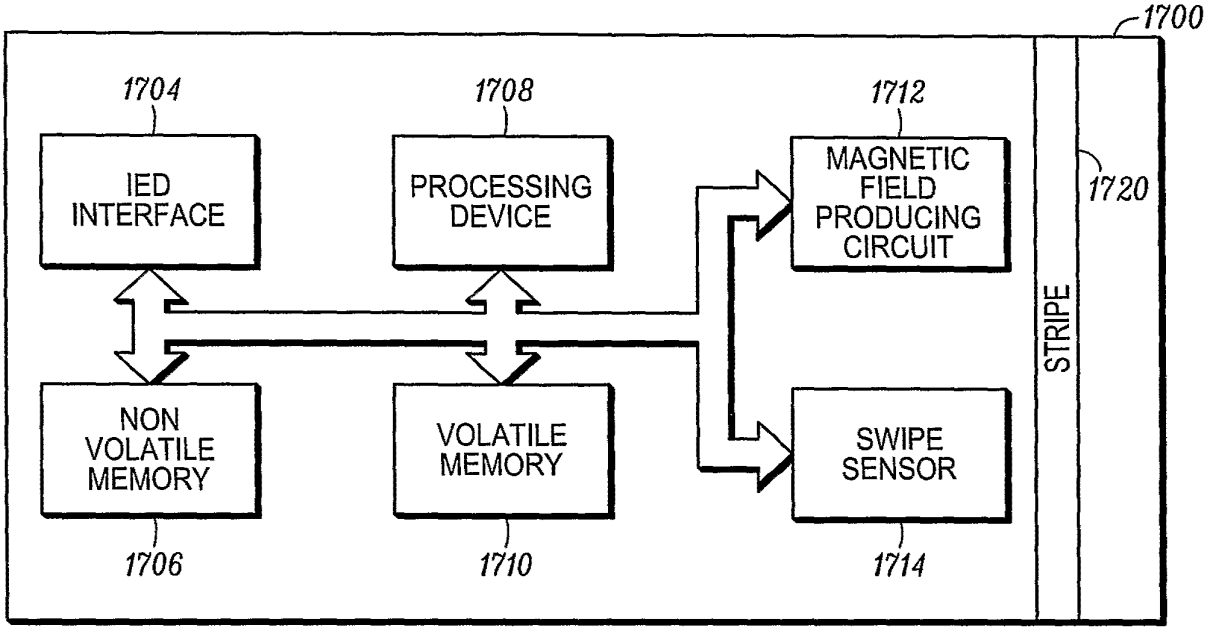

1700
1704
IED INTERFACE
1708
PROCESSING DEVICE
1712
MAGNETIC FIELD PRODUCING CIRCUIT
1720
STRIPE
NON VOLATILE MEMORY
1706
VOLATILE MEMORY
1710
SWIPE SENSOR
1714

FIG. 17

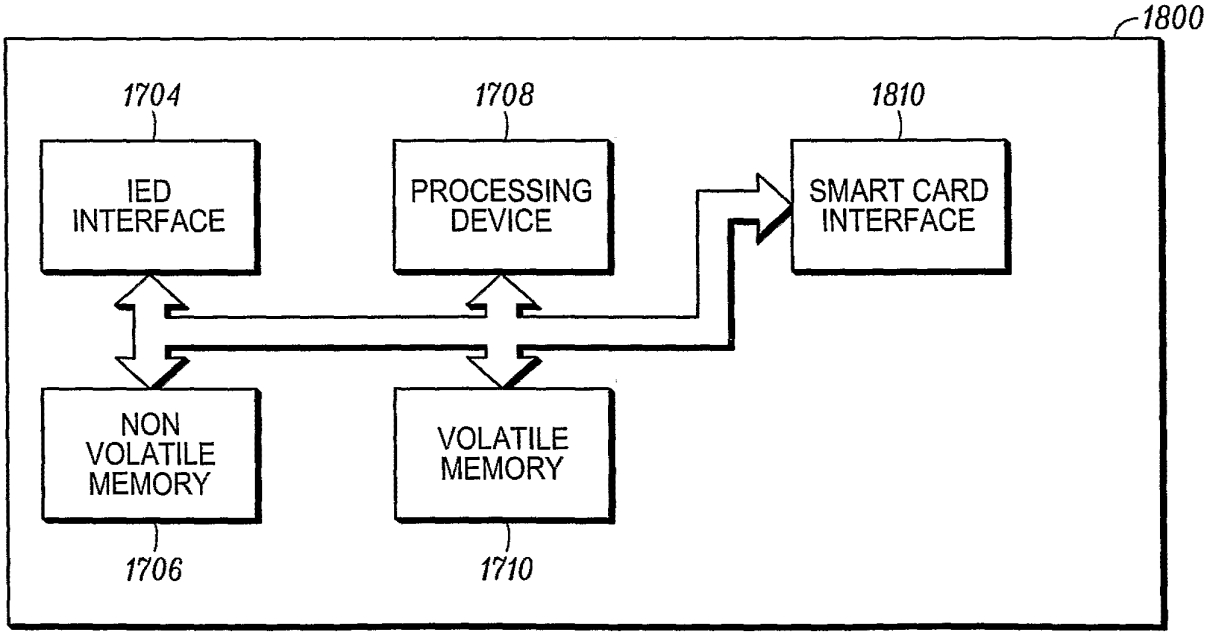

1800
1704
IED INTERFACE
1708
PROCESSING DEVICE
1810
SMART CARD INTERFACE
NON VOLATILE MEMORY
1706
VOLATILE MEMORY
1710

FIG. 18

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/013603

A. CLASSIFICATION OF SUBJECT MATTER
INV. G07F7/10 G07F7/08 G06K19/077

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)
G07F G06K

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98/12674 A (WAVE HOLDINGS LIMITED; WHITE, MARTIN, DAVID; FIELD, JOHN, DESMOND) 26 March 1998 (1998-03-26) abstract; claims 1,8; figures 1,2,4,5,7,8 page 4, line 64 - page 6, line 120 page 7, line 133 - page 9, line 164 page 11, line 203 - line 206 page 18, line 344 - page 20, line 397	1-25
X	EP 1 117 068 A (C. MEDIA CO. LTD; ITOCHU CORPORATION) 18 July 2001 (2001-07-18) column 19, line 19 - line 49; figure 12c	1-25
X	EP 1 014 290 A (NOKIA CORPORATION; NOKIA MOBILE PHONES LTD) 28 June 2000 (2000-06-28) abstract; claims 1,4,5,8; figure 6	1

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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

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"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 date claimed

"T" 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

"X" 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

"Y" 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.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 August 2006	01/09/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Mülthaler, E

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/013603

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	EP 1 189 465 A (SONY DEUTSCHLAND GMBH) 20 March 2002 (2002-03-20) the whole document	1-25
Y	DE 100 54 890 A1 (SCHNEIDER, BERND) 25 April 2002 (2002-04-25) the whole document	1-25
Y	US 2002/130187 A1 (BERG JON N ET AL) 19 September 2002 (2002-09-19) the whole document	1-25
Y	EP 0 818 757 A (AT&T CORP) 14 January 1998 (1998-01-14) abstract; figures 2-5 column 4, line 14 - column 5, line 12	1-25
A	US 6 250 557 B1 (FORSLUND PÄR ET AL) 26 June 2001 (2001-06-26) column 2, line 39 - line 47 column 3, line 19 - line 34 column 3, line 56 - column 4, line 22	1-25
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/013603

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DE 3632294 A1	07-04-1988	NONE	

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25 January 2007 (25.01.2007)

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(10) International Publication Number
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60/700,200	18 July 2005 (18.07.2005)	US
60/700,248	18 July 2005 (18.07.2005)	US

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(75) Inventors/Applicants *(for US only)*: **NARENDRA, Siva G.** [IN/US]; 7180 SW, 84th Ave., Portland, or 97223 (US). **TADEPALLI, Prabhakar** [US/IN]; 290 Phase II, Adarsh Palm Meadows, Airport Whitefield Road, Bangalore, karnataka 560 066 (IN). **SPITZER, Thomas N.** [US/US]; 2642 SW, Bucharest Ct., Portland, or 97225 (US).

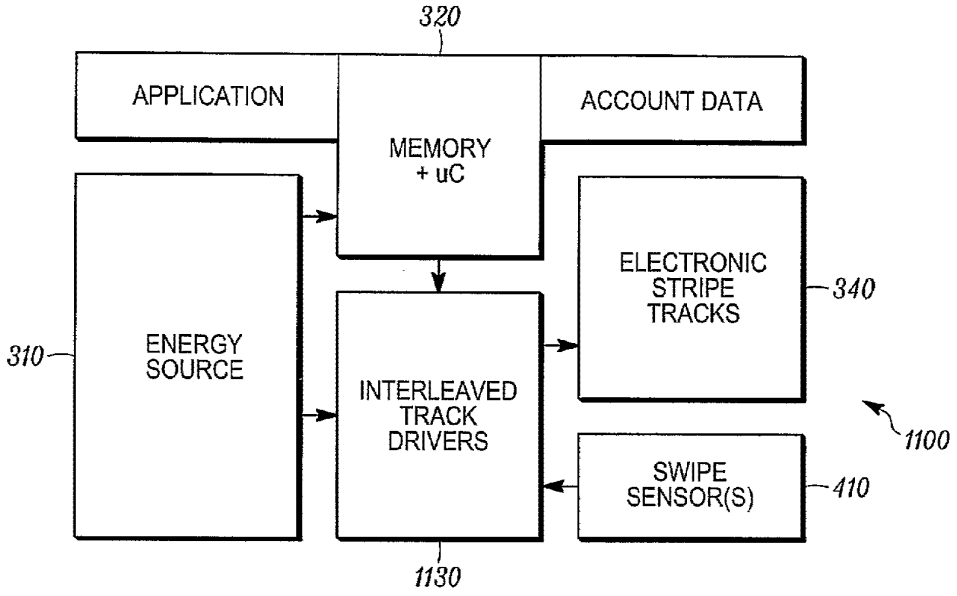
(74) Agent: **LEMOINE PATENT SERVICES**; C/o Intellevate LLC-Patent & Trademark Services, 900 Second Ave South, Suite 1700, Minneapolis, MN 55402 (US).

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[Continued on next page]

(54) Title: ELECTRONIC STRIPE CARDS



(57) Abstract: An electronic stripe card senses when it is being swiped passed a read head, and drives a conductive path to mimic a magnetic card track. Multiple conductive paths may be driven in an interleaved fashion one after another. The card may include multiple swipe sensors to detect when to start and stop driving the conductive paths. The conductive paths may include traces on a top metal layer and bottom metal layer without magnetic material therebetween.

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RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ELECTRONIC STRIPE CARDS

Brief Description of the Drawings

Figures 1 and 2 show prior art magnetic field generation;

Figures 3 and 4 show diagrams of electronic stripe cards in accordance with various embodiments of the present invention;

Figures 5-8 show magnetic field generation in accordance with various embodiments of the present invention;

Figure 9 shows swipe sensor contacts and a read head in relation to an electronic stripe card;

Figure 10 shows a plot of swipe sensor impedance; and

Figure 11 shows a diagram of an electronic stripe card in accordance with various embodiments of the present invention.

Background

As shown in Figures 1 and 2, in the prior art, a coil around a magnetic material is used to generate magnetic field that "adds" up inside the magnetic material by using the same biasing current. The direction of flow of current in the top layer is opposite in the z-axis to that of the bottom layer, but the field lines below the top metal layer and above the bottom metal layer are confined in the magnetic field and will be along the same direction.

Description of Embodiments

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, various embodiments of an invention. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described in connection with one embodiment may be implemented within other embodiments without

departing from the spirit and scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the spirit and scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

Figures 3 and 4 show diagrams of electronic stripe cards in accordance with various embodiments of the present invention. Electronic stripe card 300 (Figure 3) includes memory and microcontroller 320, energy source 310, track drivers 330, and electronic stripe tracks 340. Memory and microcontroller 320 may include application software, account data, and any other software and data. Energy source 310 may be any suitable energy source for providing energy to the remaining devices shown in Figure 3. Electronic stripe tracks 340 may be implemented using magnetic field generation circuits described with reference to later figures. Further, electronic stripe tracks 340 may include multiple magnetic field generation circuits to generate magnetic fields corresponding to multiple magnetic card tracks. Track drivers 330 provide driving signals to electronic stripe tracks 340 to effect the generation of magnetic fields.

Electronic stripe card 400 (Figure 4) includes memory and microcontroller 320, energy source 310, and electronic stripe tracks 340, all of which are described in the previous paragraph. Electronic stripe card 400 also includes track drivers 430 and swipe sensor 410.

Swipe sensor 410 may sense when the card is swiped past a magnetic card reader head, and track drivers 430 may operate in response thereto. For example, with input from swipe sensor 410, the microcontroller (uC) can sense when the track driving needs to begin and/or end, making the energy consumption much lower. Swipe sensor 410 may be implemented using optical sensors, mechanical sensors or electrical sensors. Example embodiments of swipe sensors are described further below with reference to later figures. Without a swipe sensor, the track drivers

continuously drive the electronic stripes. This will consume energy from the energy source irrespective of if the card is being swiped or not.

Figures 5-8 show magnetic field generation in accordance with various embodiments of the present invention. As shown in Figures 5 and 6, flux lines spread out due to absence of magnetic material and therefore are in the opposite direction resulting in canceling of the magnetic fields due to current flow in the top with that of the bottom metal layers.

As shown in Figures 7 and 8, in various embodiments of the present invention, the same bias current is used without magnetic material, while preventing the canceling of field lines by re-routing the bottom metal layer further away along the x-axis. Physical separation of the bottom with the top layers ensures that the flux lines do not cancel each other. The flux lines in the top metal layer might also add-up. Note that the metal width along the x-axis for the top and bottom layers do not have to be the same. This design ensures that the metal conductors in one side of the layout carry current in the same direction. Use of more than two layers of metal can help improve this effect.

Various embodiments of the present invention can be used as the design for electronic stripe tracks 340 (Figures 3, 4) to reuse the same bias current and generate magnetic field(s) that mimic the standard magnetic stripe functionality. This solution does not require magnetic material. Further, this solution does not suffer from flux cancellation.

Figure 9 shows swipe sensor contacts and a read head in relation to an electronic stripe card. Swipe sensor contacts 920 are shown as two metal islands on electronic stripe card 910. Read head 930 represents a metal read head in a magnetic card reader such as a point-of-sale (POS) card reader. Since the read head is made out of metal, a swipe sensor that resides on the card with two metal islands spaced closely can be effective. When the read head is in between the two metal islands they will be shorted to each other via the read head. Any other position of the read head will leave these two lines open. By sensing the impedance or by measuring corresponding current/voltage between these two metal islands a swipe

sensor such as swipe sensor 410 (Figure 4) may be implemented. During the swiping action of electronic stripe card 910 through a card reader, the sensor is activated when read head 930 is on top of, and in between, the two metal islands shown at 920.

Figure 10 shows a plot of swipe sensor impedance. As shown in Figure 10, the impedance between the two islands may drop when the read head shorts the two islands together. The sensor may detect this condition and activate track driving to generate magnetic field(s) to mimic a standard magnetic card.

In some embodiments, multiple swipe sensors exist. For example, one swipe sensor may be on each end of electronic stripe card 910. In these embodiments, track driving may start when the first sensor is activated, and track driving may stop when the second sensor is activated. Alternatively, the activation of the first sensor may trigger the driving of the stripe and the driving is automatically stopped after sending all the data to the electronic stripe a predetermined number of times. In addition, swipe sensors may be on one or both sides of the electronic stripe card.

Figure 11 shows a diagram of an electronic stripe card in accordance with various embodiments of the present invention. Electronic stripe card 1100 includes memory and microcontroller 320, energy source 310, electronic stripe tracks 340, and swipe sensors 410, all of which are described above. Electronic stripe card 1100 also includes interleaved track drivers 1130.

Most financial cards have two tracks of data. The data stored in these two tracks are read by two independent card reader circuits in the card reader. In a traditional magnetic stripe card since the data for the two tracks are physically recorded on the stripes they are read simultaneously. In various electronic stripe embodiments of the present invention, the data is not stored physically in the stripes, but rather electronically programmed one bit at a time. Since the time slot required for a bit is usually much smaller compared to the time it takes to swipe the entire card, it is possible to drive one track at a time. This is accomplished by first sending the entire data for one of the tracks, followed by the entire track data for the next track. When no data is sent, the track does not consume any current. For a two

track system, track interleaving reduces the power consumption by a factor of two and completely eliminates any cross-talk between tracks.

Track interleaving can be done with or without swipe sensors. In some embodiments, there are two swipe sensors for the whole card – one on each end. In these embodiments, activation of one of the swipe sensors may lead to driving of the tracks in an interleaved fashion. The driving can stop after driving the tracks for a predetermined number of times or after the activation of the other swipe sensor. In some embodiments, swipe sensors are dedicate to each track. For example, when one swipe sensor is swiped past a read head, a first track may be driven, and when a second swipe sensor is swiped past the read head, a second track may be driven. Track interleaving for power saving is also valid for designs with more than two tracks.

The various embodiments described herein may be applicable to financial cards, credit/debit cards, and other such cards. Further, the various embodiments may be used in merchant point-of-sale retail locations, automatic teller machine (ATM) locations, or wherever such cards may be read. Still further, the various embodiments may be used for purposes other than financial cards. For example, the various embodiments may be used for access control.

Although the present invention has been described in conjunction with certain embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art readily understand. Such modifications and variations are considered to be within the scope of the invention and the appended claims.

What is claimed is:

1. An electronic stripe card comprising:

a conductive path having first portions oriented to carry current in a "z" direction and having second portions oriented to carry current in a "-z" direction, wherein the first and second portions are separated by a sufficient distance to allow a magnetic field created by the first portions to mimic a magnetic track without interference from a magnetic field created by the second portions.

2. The electronic stripe card of claim 4 further comprising a metal layer on one side of the electronic stripe card, wherein the conductive path is formed on the metal layer.

3. The electronic stripe card of claim 4 further comprising:

a top metal layer and a bottom metal layer without magnetic material therebetween, wherein the conductive path is partially on the top metal layer and partially on the bottom metal layer.

4. An electronic stripe card comprising:

a top metal layer and a bottom metal layer without magnetic material therebetween; and

a conductive path alternating between the top metal layer and the bottom metal layer, wherein the conductive path on the top metal layer is remote from the conductive path on the bottom metal layer to reduce magnetic flux interference.

5. The electronic stripe card of claim 4 wherein the conductive path on the top metal layer has a different width from the conductive layer on the bottom metal layer.

6. The electronic stripe card of claim 4 further comprising track driving circuitry to provide current to the conductive path.

7. The electronic stripe card of claim 6 further comprising a swipe sensor to detect when the electronic stripe card is swiped past a read head.

8. The electronic stripe card of claim 7 wherein the track driving circuitry is responsive to the swipe sensor to active when the electronic stripe card is swiped past the read head.

9. The electronic stripe card of claim 8 further comprising a second swipe sensor.

10. The electronic stripe card of claim 9 wherein the track driving circuitry is responsive to the second swipe sensor to deactivate the electronic stripe when the second swipe sensor is swiped past the read head.

11. The electronic stripe card of claim 4 further comprising a second conductive path alternating between the top metal layer and the bottom metal layer.

12. The electronic stripe card of claim 11 further comprising interleaving track driving circuitry to provide current to the conductive path and the second conductive path in an interleaved fashion.

13. An electronic stripe card comprising:

a first conductive path to emit a first magnetic field to mimic a first track in a magnetic card;

a second conductive path to emit a second magnetic field to mimic a second track in a magnetic card;

a swipe sensor to detect when the electronic stripe card is swiped past a read head; and

an interleaved track driver circuit responsive to the swipe sensor, to drive the first and second conductive paths one at a time.

14. The electronic stripe card of claim 13 further comprising a top metal layer and a bottom metal layer without magnetic material therebetween.

15. The electronic stripe card of claim 14 wherein the first conductive path comprises a conductive path alternating between the top metal layer and the bottom metal layer, wherein the conductive path on the top metal layer is remote from the conductive path on the bottom metal layer to reduce magnetic flux interference.

16. The electronic stripe card of claim 15 wherein the conductive path on the top metal layer is a different width from the conductive path on the bottom metal layer.

17. The electronic stripe card of claim 13 further comprising a second swipe sensor.

18. The electronic stripe card of claim 17 wherein the interleaved track driver circuit is responsive to the second swipe sensor to stop driving the first and second conductive paths.

19. A method comprising:

detecting that a swipe sensor has been swiped past a read head; and

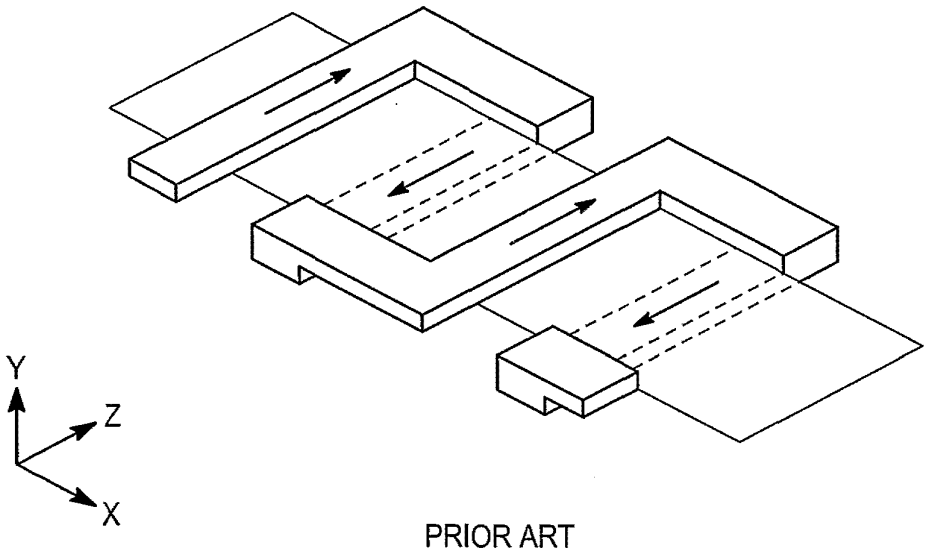
driving a first conductive path to mimic a first magnetic track and driving a second conductive path to mimic a second magnetic track, wherein the driving of the first and second conductive paths is interleaved.

20. The method of claim 19 further comprising detecting that a second swipe sensor has been swiped past the read head.

21. The method of claim 20 further comprising stopping driving when the second swipe sensor is detected.

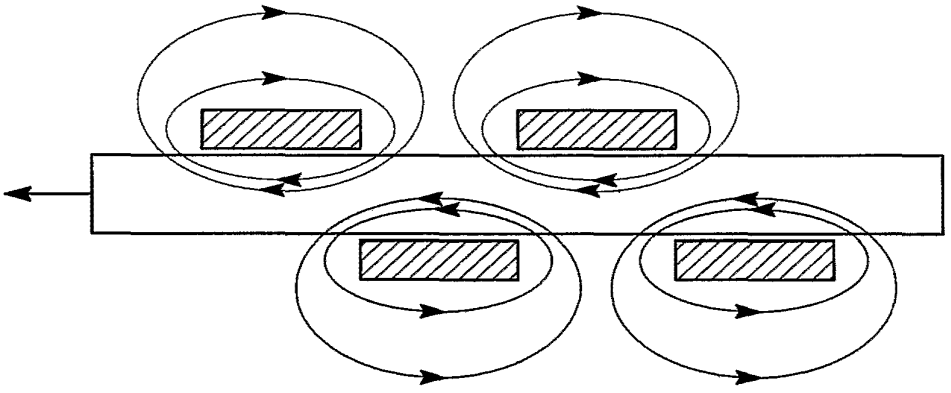
22. The method of claim 19 wherein driving a first conductive path comprises driving a first conductive path alternating between a top metal layer and a bottom metal layer, wherein the conductive path on the top metal layer is remote from the conductive path on the bottom metal layer to reduce magnetic flux interference.

23. The method of claim 19 wherein driving a first conductive path comprises driving a first conductive path alternating between a top metal layer and a bottom metal layer without magnetic material therebetween, wherein the conductive path on the top metal layer is remote from the conductive path on the bottom metal layer to reduce magnetic flux interference.



PRIOR ART

FIG. 1



PRIOR ART

FIG. 2

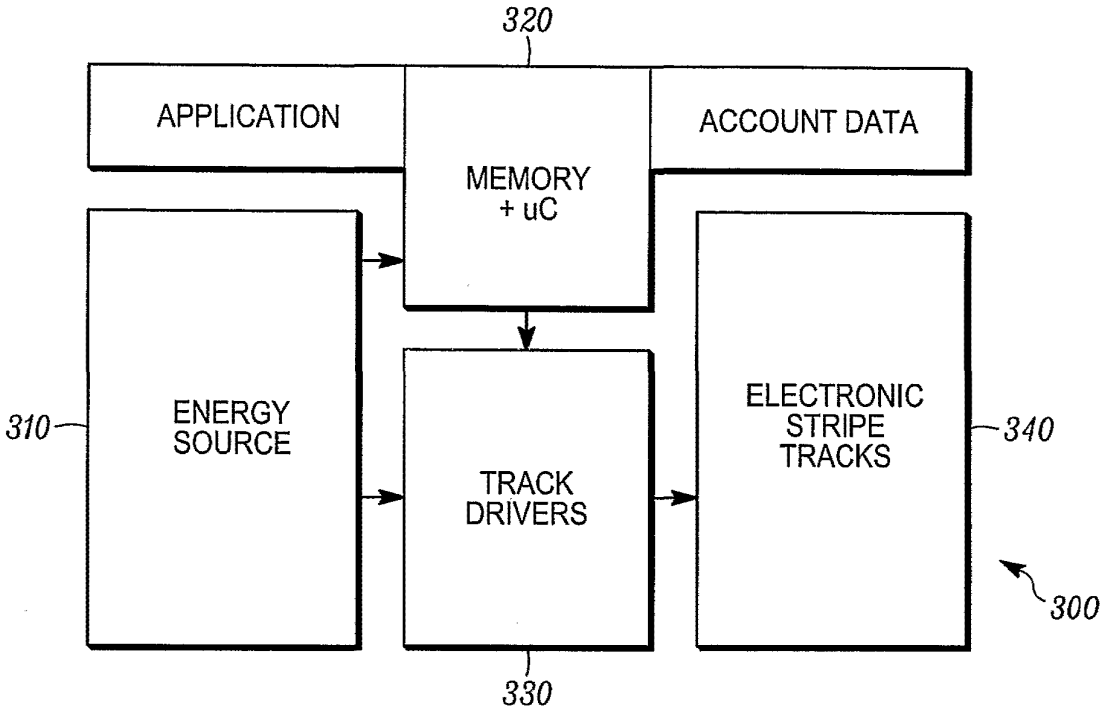

320
APPLICATION
MEMORY
+ uC
ACCOUNT DATA
310
ENERGY
SOURCE
TRACK
DRIVERS
ELECTRONIC
STRIPE
TRACKS
340
300
330

FIG. 3

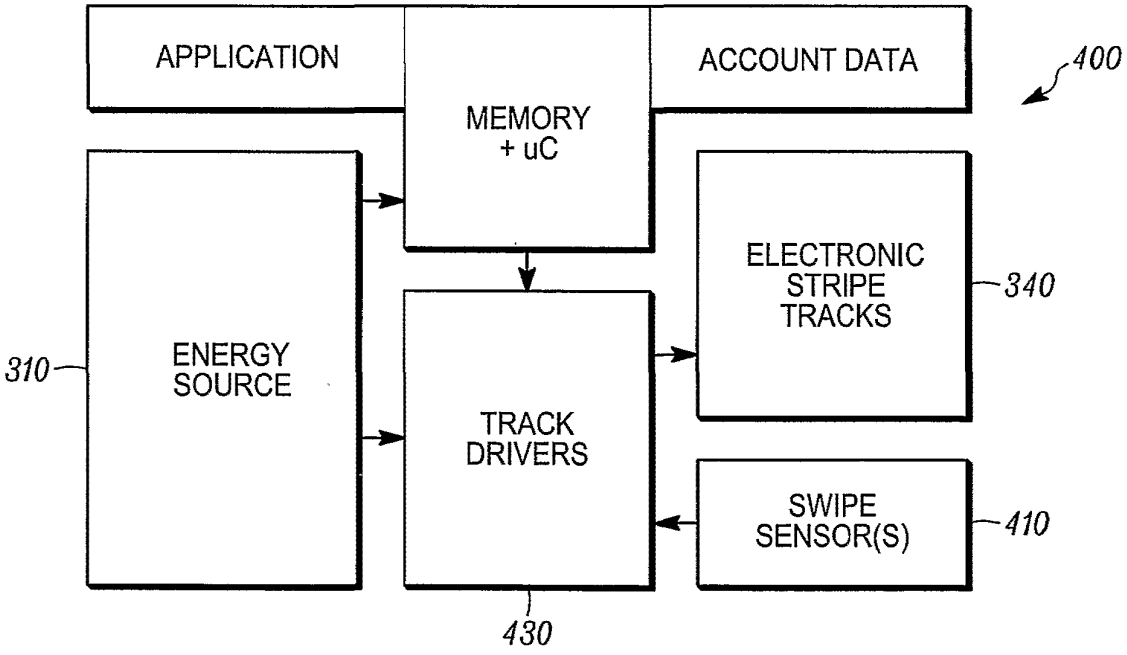

APPLICATION
MEMORY
+ uC
ACCOUNT DATA
400
310
ENERGY
SOURCE
TRACK
DRIVERS
ELECTRONIC
STRIPE
TRACKS
340
SWIPE
SENSOR(S)
410
430

FIG. 4

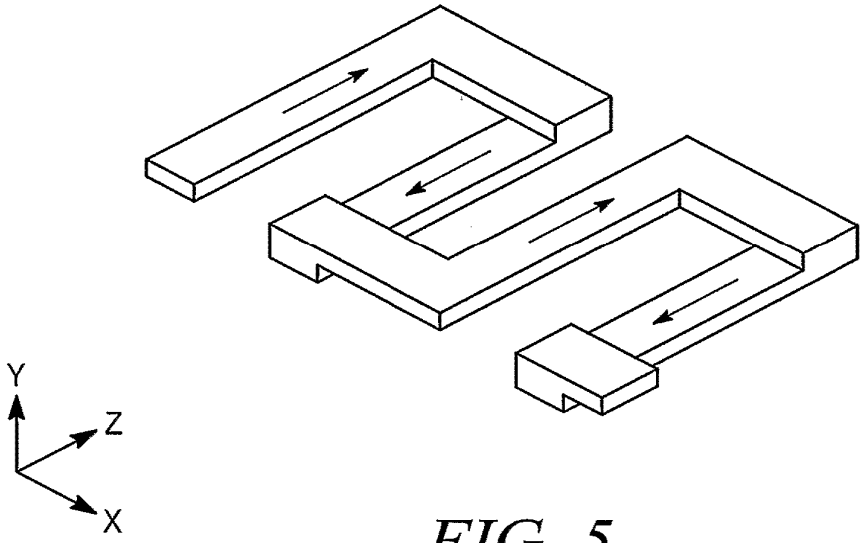


FIG. 5

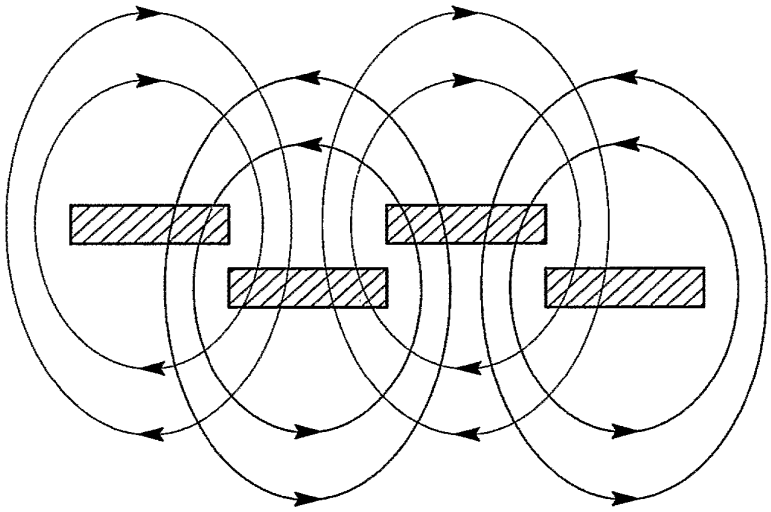


FIG. 6

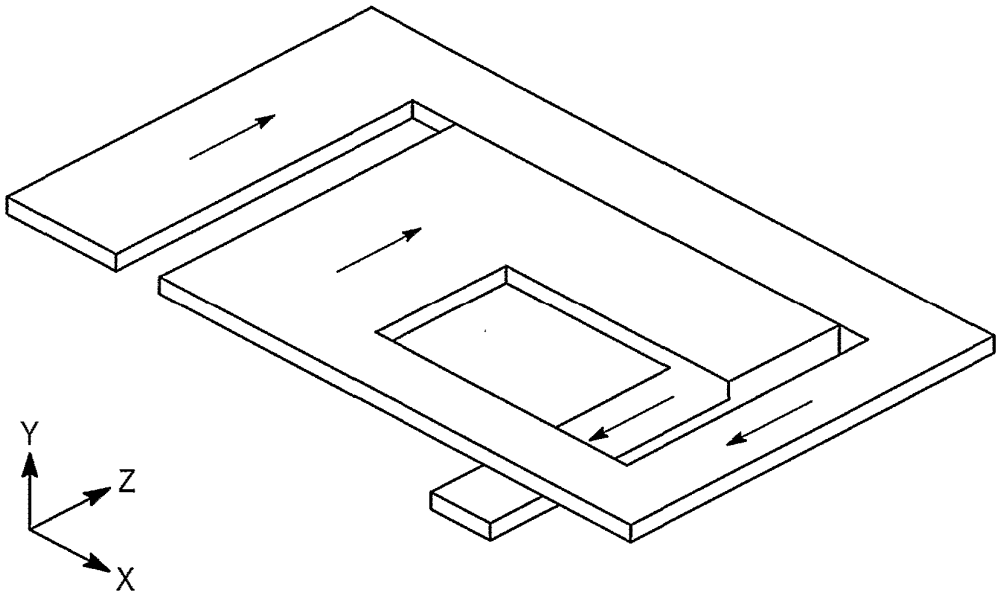


FIG. 7

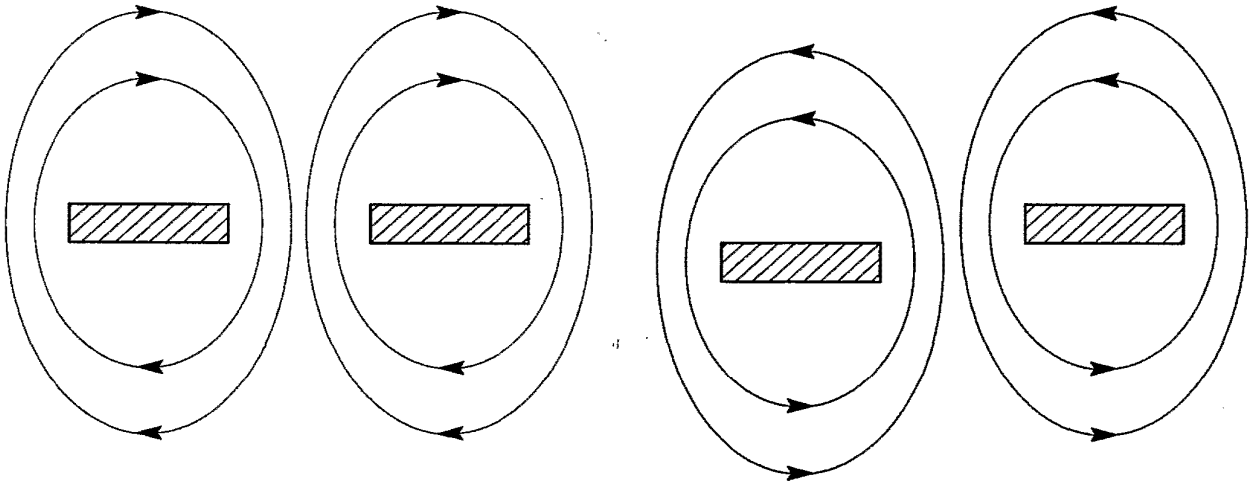


FIG. 8

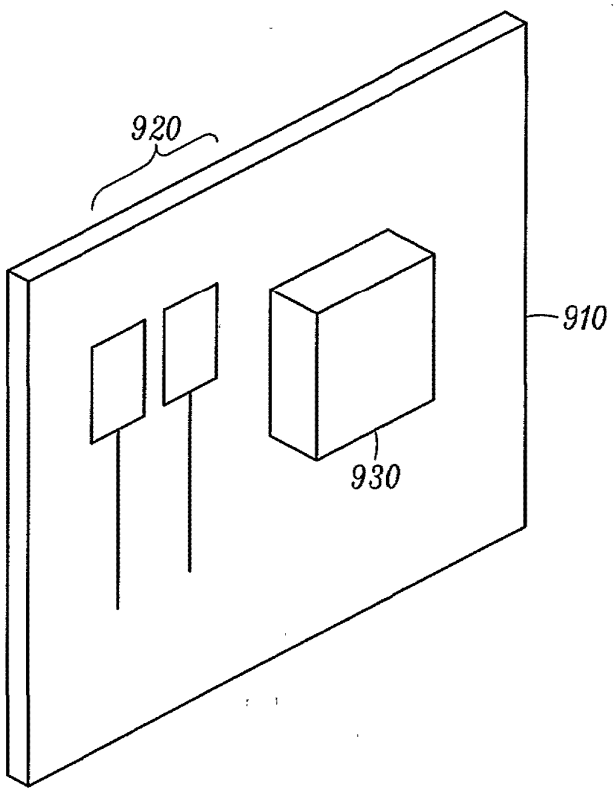

920
910
930

FIG. 9

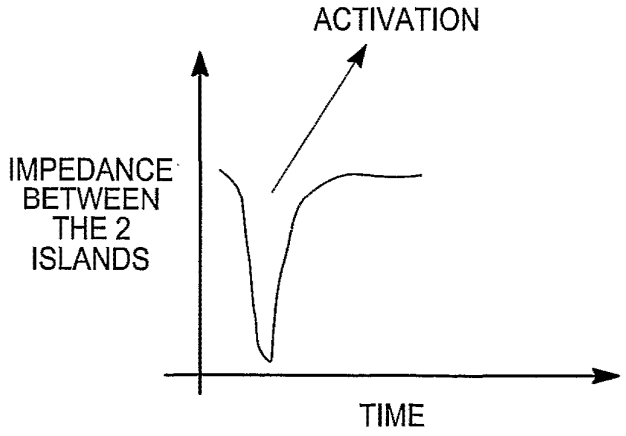

ACTIVATION
IMPEDANCE BETWEEN THE 2 ISLANDS
TIME

FIG. 10

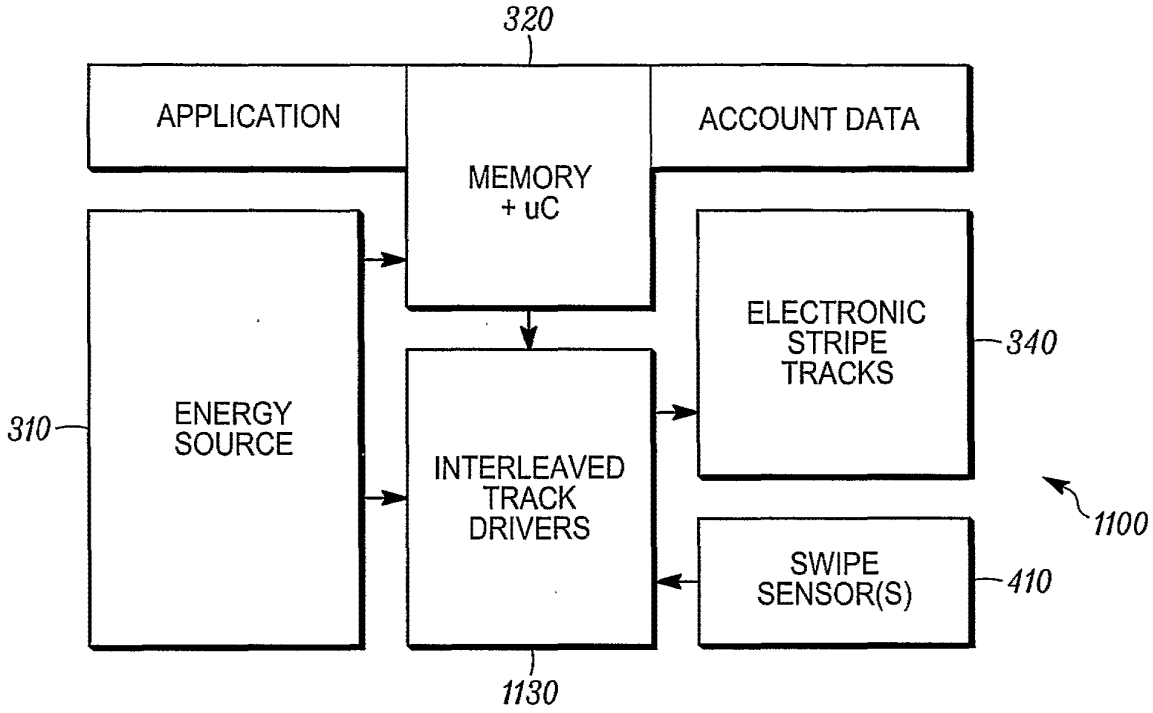

320
APPLICATION
MEMORY
+ uC
ACCOUNT DATA
ENERGY
SOURCE
310
INTERLEAVED
TRACK
DRIVERS
ELECTRONIC
STRIPE
TRACKS
340
1100
SWIPE
SENSOR(S)
410
1130

FIG. 11

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(54) **Title:** MEMORY CARD HIDDEN COMMAND PROTOCOL

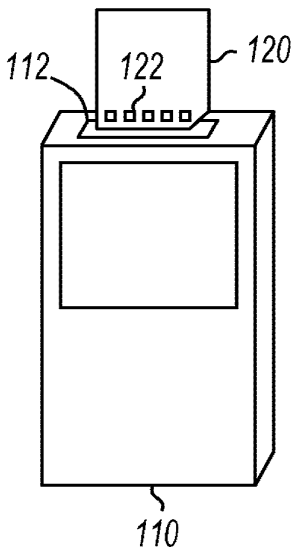


FIG. 1

(57) **Abstract:** A memory card compatible token includes non-memory components accessed using commands hidden in the data stream of a memory card access command. A mobile computing device such as a mobile phone accesses the non-memory components by writing to a specific address, including a known data value in the data stream, or both. The token may be activated using an activation code, and a subsequently chosen password may be used to authenticate the mobile computing device to the token each time a hidden command is issued.

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MEMORY CARD HIDDEN COMMAND PROTOCOL

Field

The present invention relates generally to communications protocols, and more specifically to communications protocols between mobile computing devices and add-on cards.

Background

Many mobile computing devices (such as mobile phones) have memory card slots to accept memory cards. Communication protocols between memory cards and mobile computing devices typically include standardized memory card access commands. Standardization increases interoperability between various types and brands of mobile computing devices and memory cards.

Brief Description of the Drawings

Figure 1 shows a mobile computing device and a token compatible with a memory card slot;

Figure 2 shows a block diagram of a mobile computing device;

Figures 3 and 4 show block diagrams of tokens that communicate with memory card slots in mobile computing devices;

Figure 5 shows a data portion of a memory card write command; and

Figure 6-9 show flowcharts of methods in accordance with various embodiments of the present invention.

Description of Embodiments

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, various embodiments of an invention. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of

the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described in connection with one embodiment may be implemented within other embodiments without departing from the spirit and scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the spirit and scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

Figure 1 shows a mobile computing device and a token compatible with a memory card slot. Mobile computing device 110 is shown as a mobile phone in Figure 1, but this is not a limitation of the present invention. For example, mobile computing device 110 may be a personal digital assistant (PDA), a smartphone, a mobile phone, a handheld computer, a desktop computer, or any other device capable of operating as described herein.

Mobile computing device 110 includes memory card slot 112. Memory card slot 112 is a slot capable of accepting token 120. For example, memory card slot 112 may have physical dimensions compatible with token 120, and may have a communications interface that operates using a protocol compatible with token 120. In some embodiments of the present invention, memory card slot 112 is a memory card slot designed to accept and communicate with memory cards. As used herein, the term "memory card slot" refers to any add-on slot capable of accepting a card having memory accessible by a mobile computing device such as that shown in Figure 1. For example, a memory card slot may be compatible with an industry standard communications protocol, or may be compatible with a widely accepted communications protocol that is not necessarily formally documented as an industry standard. Examples include slots that are compatible with the Multimedia Memory Card (MMC) protocol, Memory Stick DUO protocol, secure digital (SD) protocol,

and Smart Media protocol. The foregoing list is meant to be exemplary, and not exhaustive. Memory card slot 112 may be compatible with many memory card slot protocols other than those explicitly listed above without departing from the scope of the invention.

Token 120 includes electrical contacts 122 as part of a host interface that communicates with memory card slot 112. For example, electrical contacts 122 may provide connectivity compliant with a communications protocol for memory cards. In some embodiments, token 120 includes a "contactless" interface to communicate with memory card slot 112. For example, electronic token 120 may include an interface to memory card slot 112 that communicates using electric or magnetic fields, infrared (IR) light, or any other suitable communications mechanism.

Token 120 may include memory and may also include additional functionality. In some embodiments, token 120 includes memory accessible by mobile computing device 110 and also includes additional functionality. In other embodiments, token 120 does not include memory accessible by mobile computing device 110. The additional functionality of token 120 may take any form and the various embodiments of the present invention are not limited in this regard.

In various embodiments of the present invention, the additional functionality in token 120 is accessed by mobile computing device 110 using memory card access commands already defined for use in memory card slot 112. Accordingly, the various embodiments of the present invention enable the implementation of token functions beyond memory accesses without defining new commands. In some embodiments, new commands for the token are embedded inside the data bits subsequent to memory card read/write commands. Token 120 then decides if the incoming data bits are meant for regular read/write functions or for the new functions. In other words, additional token functions may be accessed through commands "hidden" in the data stream that can be exchanged using existing memory card access commands and functions. According to the various embodiments of the invention, both existing memory card functions and new

functions may be implemented without requiring changes in how the host protocol is built.

Figure 2 shows a block diagram of a mobile computing device. Mobile computing device 110 includes antenna 240, radio circuits 230, processor 210, memory 220, and memory card slot 112. In some embodiments, mobile computing device 110 is a mobile phone, or includes mobile phone functionality. For example, antenna 240 and radio circuits 230 may be utilized to communicate with a cellular telephone network. Further, in some embodiments, mobile computing device 110 is a wireless local area network (WLAN) or wireless wide area network (WWAN) device. For example, antenna 240 and radio circuits 230 may be utilized to communicate with a wireless access point. In some embodiments, antenna 240 and radio circuits 230 are omitted, and mobile computing device 110 does not utilize wireless connectivity.

Processor 210 represents a processor capable of communicating with the other blocks shown in mobile computing device 110. For example, processor 210 may be a microprocessor, a digital signal processor (DSP), a microcontroller, or the like. Further, processor 210 may be formed from state machines or other sequential logic. In operation, processor 210 may read instructions from memory 220 and perform actions in response thereto. For example, processor 210 may execute program instructions that influence communications between mobile computing device 110 and a device coupled to memory card slot 112.

Memory card slot 112 is described above with reference to Figure 1. Memory card slot 112 includes circuitry compatible with token 120. Mobile computing device 110 may communicate with token 120 by using a standard set of memory card access commands. For example, processor 210 may use memory card write commands to write to memory in token 120, and may use memory card read commands to read from memory in token 120.

Mobile computing device 110 may access additional functionality in token 120 using "hidden" commands embedded in memory card access commands. For example, a memory card write command may include a unique data string to

identify the memory card write command as a command to be diverted for purposes other than a memory write. In addition, the sector address provided with the memory card write command may be set to a particular address value to further identify the memory card write command as a command to be diverted. In addition to specific address/data values to identify the memory card access command as a command to be diverted for a purpose other than a memory access, the memory access command may include data bits to further specify the type and function of hidden command. Example formats of hidden commands are described further below. In some embodiments, a read command is issued right after a write command to enable data flow from the non-memory card functions to the host, where the write command's data had the hidden commands. The combination of a memory card write command and a memory card read command can be used in this manner to form a hidden read command.

Figure 3 shows a block diagram of a token that communicates with a memory card slot in a mobile computing device. Token 300 includes host interface 310, command routing component 320, memory control component 340, non-memory control component 330, memory 360, and optional functions 350. Token 300 may be any type of token capable of communicating with a memory card slot in a mobile computing device. Further, token 300 may take any form factor compatible with a memory card slot.

Memory 360 may be any type of volatile or non-volatile memory. For example, memory 360 may be volatile memory such as static random access memory (SRAM) or dynamic random access memory (DRAM). Also for example, memory 360 may be nonvolatile memory such as NOR FLASH memory or NAND FLASH memory. In various embodiments of the present invention, memory 360 represents memory that is accessed by a mobile computing device using memory card access commands defined for that purpose.

Optional functions 350 may include any function that can be added to token 300. As described further below, optional functions 350 may be accessed by a

mobile computing device by sending hidden commands within a memory card access command.

Host interface 310 includes electrical contacts to interface with a memory card slot. For example, in some embodiments, host interface 310 includes contacts such as contacts 122 (Figure 1). Also for example, in some embodiments, host interface 310 includes recessed electrical contacts. Host interface 310 may also include circuitry such as drivers, receivers, terminations, and the like.

Command routing component 320 functions to route memory card access commands received from host interface 310. Commands may be routed to memory control component 340 for memory accesses, or may be routed (diverted) to non-memory control component 330 for purposes other than memory accesses. For example, when token 300 is communicating with a memory card slot in a mobile computing device, the mobile computing device may send a memory card access command in order to access memory 360. Also for example, the mobile computing device may send a memory card access command that contains a hidden command. Command routing component 320 detects the presence of the hidden command, and diverts all or a portion of the memory access command to non-memory control component 330.

Command routing component 320 can detect the hidden command in many ways. For example, in some embodiments, the memory card access command may include a specific address value or a specific data value. Command routing component 320 detects commands that include one or both of the specific address value or specific data value and routes the command appropriately. The specific address value and specific data value used for this purpose are referred to herein as the hidden command address value and the hidden command data value.

In some embodiments, command routing component 320 diverts commands based only on the hidden command address value. In these embodiments, command routing component 320 checks the address value included in memory card access command, and diverts the command if it matches the hidden command address value. In some embodiments, command routing component 320 diverts commands

based only on the hidden command data value. In these embodiments, command routing component 320 checks a data value included in the memory card access command, and diverts the command if it matches the hidden command data value. In still further embodiments, command routing component 320 diverts commands based on both the hidden command address value and the hidden command data value. In these embodiments, command routing component 320 diverts the command only if both the memory card access address and data match the hidden command address value and data value, respectively.

The hidden command address value and hidden command data value may be specified in many ways. For example, all tokens may be issued with fixed values. In these embodiments, each time the optional functions are accessed, the same hidden command address and/or data value is included in the memory card access command. Also for example, different tokens may be issued with unique values. In these embodiments, each token may provide these values to a mobile computing device when queried. Also for example, hidden command address and/or data values may be specified by the mobile computing device. In still further embodiments, hidden command address and data values may be dynamic. The hidden command address and data values may change each time power is applied or on a periodic basis.

In various embodiments of the invention, command routing component 320, memory control component 340, and non-memory control component are implemented in many different ways. For example, in some embodiments, the various components are implemented in hardware. In these embodiments, the various components may be implemented as separate integrated circuits, or in a combined integrated circuit. Also for example, in some embodiments, the various components may be implemented in software, or in a combination of hardware and software. In some embodiments, token 300 may include a microprocessor, and the components may be implemented as software modules running on the microprocessor. In other embodiments, token 300 may includes multiple

processors, and the components may be implemented as software modules distributed across the multiple processors.

Figure 4 shows a token in accordance with various embodiments of the present invention. Token 400 includes host interface 310, memory card controller 440, memory 360, secondary controller 430, program memory 432, and optional functions 350. Host interface 310, memory 360, and optional functions 350 are described above with reference to Figure 3.

In embodiments represented by Figure 4, memory card controller 440 communicates with the mobile device using memory card access commands. Memory card controller 440 also communicates with memory 360. Memory card controller 440 determines whether each command should result in a memory operation with memory 360, or whether the command should be diverted to secondary controller 430. In some embodiments, memory card controller 440 executes instructions that are stored in an internal memory or stored in memory 360. In some embodiments, memory card controller 440 includes special purpose hardware useful to determine whether a command should be diverted. In other embodiments, memory card controller 440 may be a microcontroller identical in all respects to a controller found in memory cards, except for the program that it executes.

Secondary controller 430 receives hidden commands diverted by memory card controller 440. Secondary controller 430 further interprets the hidden commands and performs actions in response thereto. For example, secondary controller 430 may command optional functions 350 to provide a service. Secondary controller 430 executes instructions stored in program memory 432. In some embodiments, program memory 432 is embedded in secondary controller 430, and in other embodiments, program memory 432 is part of memory 360.

In embodiments represented by Figure 4, memory card controller 440 includes the functionality of both command routing component 320 and memory control component 340 (Figure 3), and secondary controller 430 includes the functionality of non-memory control component 330 (Figure 3). In other

embodiments, secondary controller 430 communicates with host interface 310 and memory card controller 440, and includes the functionality of the command routing component.

Figure 5 shows a data portion of a memory card write command. Included are hidden command data value 510, status field 520, password field 530, device ID 532, command index 540, and hidden command related data 550. In the example of Figure 5, the data portion is 512 bytes in length, although this is not a limitation of the present invention. Any amount of data may be included in the write command, and each field shown in Figure 5 may be any length.

In the example of Figure 5, the hidden command data value is 256 bits long, although any length may be used without departing from the scope of the present invention. In some embodiments, hidden command data value 510 is used to identify a memory write command as a hidden command. When a write command is received having data in the first 256 bits that match the hidden command data value, the command is identified as one to be diverted for purposes other than a memory write. As described above, a hidden command address value may be used in conjunction with, or instead of, a hidden command data value to identify the memory write command as a hidden command.

The remaining fields have significance when the memory write is a hidden command. For example, if the first 256 bits do not match the hidden command data value (or if the write address does not match the hidden command address value, or both) then the remaining bits in the data field are to be treated as data in a normal memory write command. In contrast, when the memory write is a hidden command, the remaining fields are used to further interpret the hidden command.

Command routing component 320 (Figure 3) inspects the hidden command data value 510, status field 520, and possibly password field 530 and device ID 532. If the command is identified as a hidden command, command routing component 320 forwards the password 530, command index 540, and related data 550 to non-memory control component 330.

Status field 520 may include any information relating to the status of the hidden command. For example, status field 520 may include one more bits to signify to command routing component 320 whether the host (mobile computing device) is expecting the non-memory control component to return data in response to the hidden command. For example, when status field 520 signifies a write, command routing component 320 forwards the password device ID, command index, and related data without expecting to return any data to the host. Also for example, when status field 520 signifies a read, command routing component 320 forwards the password, device ID, command index, and related data with the expectation that non-memory control component 330 will provide data to be sent to the host in response to a memory card read command. The combination of a memory card write command followed shortly thereafter by a memory card read command may be used to provide "read" functionality to the non-memory control component. Read operations from the non-memory control component are described further below with reference to Figure 8.

Password field 530 includes a password to allow non-memory control component 330 to authenticate the host to the token. In some embodiments, every hidden command includes a password. Each time the password, device ID, command index, and related data is diverted to the non-memory control component, the password is checked to authenticate the host to the token.

Device ID 532 uniquely identifies the host (mobile computing device). The device ID may be checked by the non-memory control component to ensure that the token is inserted in the host to which it is authenticated. Some embodiments of the present invention enforce a unique host/token pairing using the device ID, and other embodiments allow non-memory control functions to be accessed by any host.

Command index 540 identifies the type of hidden command. The number of possible hidden commands is limited only by the number of bits allocated thereto. Any number of bits may be allocated to command index 540 without departing from the scope of the present invention. Hidden command related data 550 may be

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utilized differently for each type of hidden command. Any number of bits may be used for hidden command related data 550.

The data shown in Figure 5 is provided as an example, the data field of a memory card access command may include more or fewer data fields than those shown in Figure 5. The present invention is not limited by the number or content of the fields in a memory card access command.

Figure 6 shows a flowchart in accordance with various embodiments of the present invention. In some embodiments, method 600 may be used by a mobile computing device to communicate with a token in a memory card slot. In some embodiments, method 600, or portions thereof, is performed by a mobile computing device with a memory card slot, and in other embodiments, method 600, or portions thereof, is performed by software. The various actions in method 600 may be performed in the order presented, in a different order, or simultaneously. Further, in some embodiments, some actions listed in Figure 6 are omitted from method 600.

Method 600 begins at 610 in which a data pattern and an address value are received from a device in a memory card slot. The data pattern corresponds to the hidden command data value, and the address value corresponds to the hidden command address value. In some embodiments, the mobile device only receives the data value and in other embodiments, the mobile device only receives the address value. In some embodiments, the actions of 610 may occur once when the device is first inserted in the memory card slot. The mobile computing device may then use the address and data values each time it creates a hidden command. In other embodiments, the actions of 610 may occur each time the device is inserted in the memory slot. In still further embodiments, the actions of 610 may occur periodically. Each time the actions 610 occur, the data pattern may be the same or different, and the address value may be the same or different.

At 620, a data field of a memory card access command is populated with the data pattern to cause the command to be diverted for a purpose other than a memory access. For example, the data pattern may be written to the data field as the hidden command data value 510 (Figure 5).

At 630, an address field of the memory card access command is populated with the address value to further cause the command to be diverted for purposes other than a memory access. In some embodiments, only one of 620 or 630 is utilized. In these embodiments, the presence of a hidden command is signified by the data pattern alone, or the address value alone.

At 640, the data field of the memory card access command is populated with a command string to specify a purpose other than a memory card access. For example, the command string may be written to the data field as the command index 540 for the non-memory control component.

At 650, the data field of a memory card access command is populated with a password to authenticate access to the device coupled to the memory card slot. In some embodiments, a password is included in the data field for every hidden command. In other embodiments, a password is only included at the beginning of an exchange.

At 660, the memory card access command is sent to the device coupled to the memory card slot. For example, a mobile computing device (110, Figure 1) may send the memory card access command to a token (120, Figure 1) in a memory card slot (112, Figure 1). The token may include a command routing component (320, Figure 3) to divert the command based on the data fields populated in method 600.

Figure 7 shows a flowchart in accordance with various embodiments of the present invention. In some embodiments, method 700 may be used by token in a memory card slot. In some embodiments, method 700, or portions thereof, is performed by a command routing component within a token, and in other embodiments, method 700, or portions thereof, is performed by software. The various actions in method 700 may be performed in the order presented, in a different order, or simultaneously. Further, in some embodiments, some actions listed in Figure 7 are omitted from method 700.

Method 700 begins at 710 in which a memory card access command is received from a mobile computing device via a host interface. The actions of 710

correspond to a token in a memory card slot of a mobile computing device receiving a memory card access command.

At 720, the token checks criteria in the memory card access command to determine if the memory card access command should be diverted for other purposes. The criteria may be one or both of a hidden command data value, a hidden command address value, or both. If there is a criteria match at 730, then a hidden command is present, and at least a portion of the memory card access command is diverted at 740. If there is not a criteria match, then no hidden command is present, and a memory access is performed at 750.

Figure 8 shows a flowchart in accordance with various embodiments of the present invention. In some embodiments, method 800 may be used by token in a memory card slot. In some embodiments, method 800, or portions thereof, is performed by a command routing component within a token, and in other embodiments, method 800, or portions thereof, is performed by software. The various actions in method 800 may be performed in the order presented, in a different order, or simultaneously. Further, in some embodiments, some actions listed in Figure 8 are omitted from method 800.

Method 800 begins at 810 in which a memory card write command is received from a mobile computing device via a host interface. If the memory card write command is determined to be a hidden command, processing continues with 840; otherwise, a memory write is performed at 830.

At 840, the hidden command is diverted to a non-memory control component. If the hidden command is determined to be a "read" at 850, processing continues at 860; otherwise, the hidden command processing is done. At 860, the command routing component retrieves non-memory data from the non-memory control component, and at 870, a memory card read command is received from the mobile computing device. At 880, the non-memory data is returned to the mobile computing device.

Method 800 demonstrates how a mobile computing device can perform a read from an optional function or from a non-memory control component. The

mobile computing device issues a memory card write command with a hidden command having a status field designating a read, and then the mobile computing device issues a memory card read command. The processing in the card receives the hidden command, identifies it as a read, and then returns data to the mobile computing device in response to a subsequent memory card read command.

Figure 9 shows a method authenticating a mobile computing device to one or more functions in a token. Method 900 begins at block 910 in which an activation code is received at a token from a mobile computing device. At 920, the received activation code is compared to a code stored in the token. If the activation code matches, the token receives a password from the mobile computing device at 940, and stores the password in the token for later use at 950. If the activation code does not match, the token determines whether a number of allowable tries has been exceeded at 960. If the number of allowable tries has been exceeded, the token issuer is contacted at 970, and if the number of allowable tries has not been exceeded, the method repeats until either the activation code matches or the number of allowable tries has been exceeded.

Method 900 may be performed when a token is issued to a user. The user may be provided an activation code to "activate" the token. When the user successfully enters the activation code, the user is prompted for a password, and that password is stored for use in future hidden commands.

In some embodiments, multiple non-memory functions in a token are authenticated using method 900. For example, each of multiple non-memory functions may have stored activation codes, and each is activated separately. Each of the separately activated functions may have a different password, or the multiple functions may share a password.

What is claimed is:

1. A method comprising:

receiving a memory access command, the memory access command including an address field and a data field;

comparing at least a portion of the data field to a predetermined data value to determine if there is a match;

if there is not a match, performing a memory access according to the memory access command; and

if there is a match, diverting the memory access command for further interpretation.

2. The method of claim 1 further comprising comparing the address field with a predetermined address value to determine if there is an address match, and diverting the memory access command only when there is also an address match.

3. The method of claim 1 wherein diverting the memory access command comprises passing at least some of the data field to a non-memory controller component for further interpretation.

4. The method of claim 3 further comprising reading a password from the data field to authenticate access to the non-memory controller component.

5. An article having a machine readable medium with instructions stored thereon that when accessed result in a machine:

comparing data received with a memory write command to a predetermined data value to determine whether the memory write command should be interpreted as a memory write command or whether the memory write command should be interpreted as a command other than a memory write command.

6. The article of claim 5 wherein the instructions, when accessed, further result in the machine forwarding the memory write command to a memory controller component when the memory write command should be interpreted as a memory write command.

7. The article of claim 5 wherein the instructions, when accessed, further result in the machine forwarding the memory write command to a non-memory controller component when the memory write command should be interpreted as a command other than a memory write command.

8. An article having a machine readable medium with instructions stored thereon that when accessed result in a machine:

comparing an address field received with a memory write command to a predetermined address value to determine whether the memory write command should be interpreted as a memory write command or whether the memory write command should be interpreted as a command other than a memory write command.

9. A method comprising populating fields in a memory write command to be sent to a memory card interface by populating at least a first portion of a data field with a data pattern to identify the memory write command as a command to be diverted for purposes other than a memory write.

10. The method of claim 9 further comprising prior to populating the fields, receiving a copy of the data pattern from a device coupled to the memory card interface.

11. The method of claim 9 further comprising populating an address field with an address value to further identify the memory write command as a command to be diverted for purposes other than a memory write.

12. The method of claim 9 further comprising populating a second portion of the data field with a command index to specify a purpose other than a memory write.

13. The method of claim 9 further comprising populating a second portion of the data field with a password to authenticate access to a device coupled to the memory card interface.

14. The method of claim 9 further comprising:

issuing the memory write command to a device coupled to the memory card interface followed by issuing a memory read command to the device coupled to the memory card interface.

15. An article having a machine readable medium with instructions stored thereon that when accessed result in a mobile computing device:

accessing a non-memory control function in a device coupled to a memory card interface of the mobile computing device by populating a data field of a memory card write command with a data pattern to identify the memory card write command as a command to be diverted for a purpose other than a memory write.

16. The article of claim 15 wherein the instructions, when accessed, further result in the mobile computing device populating the data field with a password to authenticate access to the device coupled to the memory card interface.

17. The article of claim 15 wherein the instructions, when accessed, further result in the mobile computing device populating the data field with a command index to specify a purpose other than a memory write.

18. A memory card compatible device comprising:

a host interface to receive memory write commands;

a non-memory controller component coupled to the host interface to interpret data included within the memory write commands as non-memory related commands.

19. The memory card compatible device of claim 18 further comprising:

non-volatile memory;

a memory controller component coupled to the non-volatile memory; and

a memory command routing component coupled to the host interface and the non-memory controller component, the memory command routing component including logic to determine whether to route a memory write command to the memory controller or the non-memory controller based on the data included within the memory write command.

20. A device comprising:

a host interface compatible with a memory card interface of a mobile computing device; and

a memory command routing component to interpret memory card write commands to determine whether the memory card write command should be diverted for a purpose other than a memory write based on at least a portion of the data to be written, wherein the memory command routing component is coupled to receive the memory card write command from the host interface.

21. The device of claim 20 further comprising:

a memory controller component coupled to receive memory write commands from the memory command routing component.

22. The device of claim 20 further comprising:

a non-memory controller component coupled to receive diverted memory write commands from the memory command routing component.

23. A device comprising:

a host interface compatible with a memory card interface of a mobile computing device; and

a memory command routing component to interpret memory card write commands to determine whether the memory card write command should be diverted for a purpose other than a memory write based on at least a portion of an address to be written, wherein the memory command routing component is coupled to receive the memory card write command from the host interface.

24. A method comprising:

receiving, at a non-memory control component in a memory card compatible device, an activation code in a data field of a memory write command;

comparing the activation code to a known value to detect a match; and

if there is a match, requesting a password to be used in subsequent authentications to the non-memory control component in a memory card compatible device.

25. The method of claim 24 further comprising receiving non-memory related commands hidden in the data field of memory write commands, wherein the non-memory related commands include the password.

26. The method of claim 24 further comprising receiving a plurality of activation codes, wherein each of the plurality of activation codes corresponds to the activation of a different non-memory control component in the memory card compatible device.

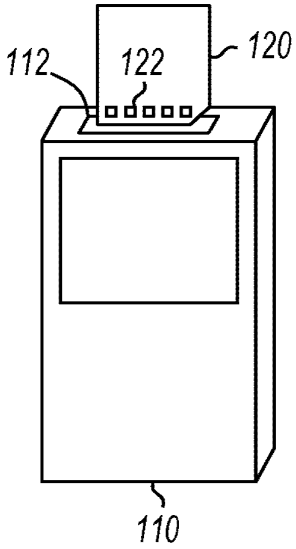

112
122
120
110

FIG. 1

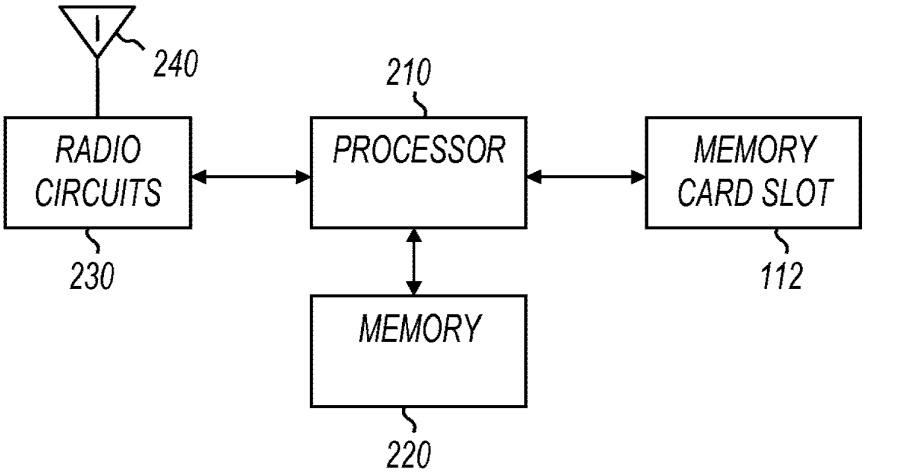

240
210
RADIO CIRCUITS
PROCESSOR
MEMORY CARD SLOT
230
112
MEMORY
220
110

FIG. 2

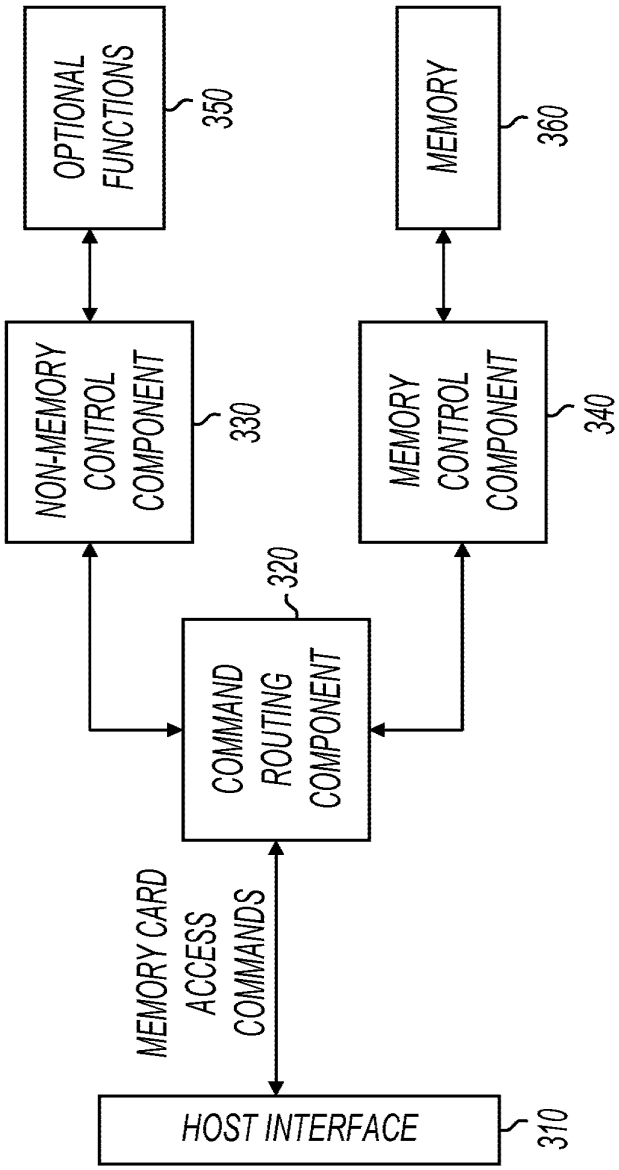

OPTIONAL FUNCTIONS
350
MEMORY
360
NON-MEMORY CONTROL COMPONENT
330
MEMORY CONTROL COMPONENT
340
320
COMMAND ROUTING COMPONENT
MEMORY CARD ACCESS COMMANDS
HOST INTERFACE
310
300

FIG. 3

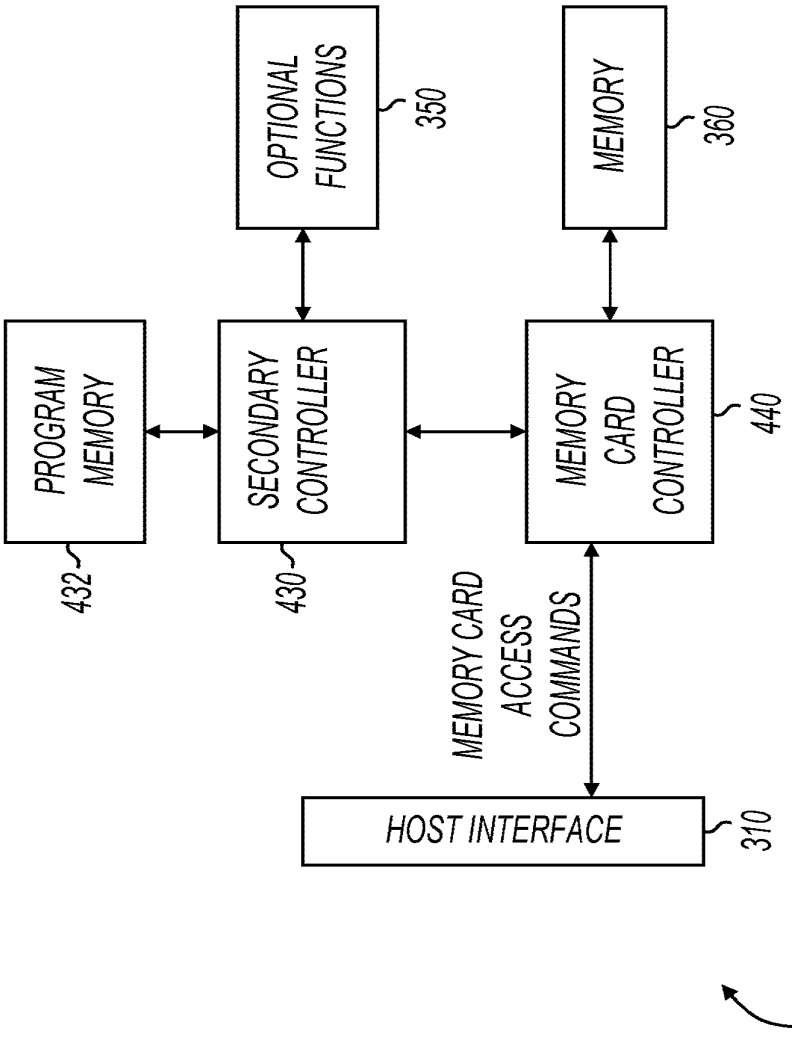

OPTIONAL FUNCTIONS
350
MEMORY
360
PROGRAM MEMORY
SECONDARY CONTROLLER
MEMORY CARD CONTROLLER
440
432
430
MEMORY CARD ACCESS COMMANDS
HOST INTERFACE
310
400

FIG. 4

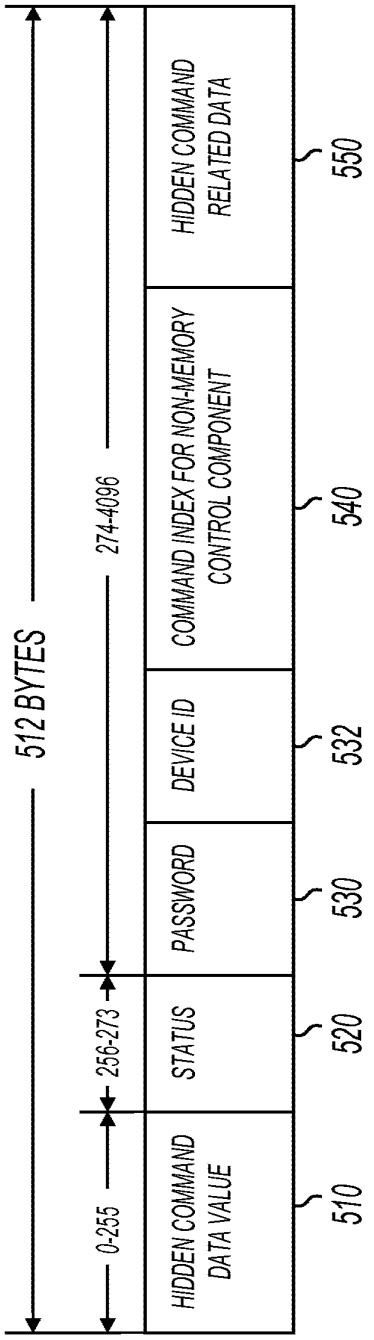

512 BYTES
274-4096
0-255
256-273
HIDDEN COMMAND DATA VALUE
STATUS
PASSWORD
DEVICE ID
COMMAND INDEX FOR NON-MEMORY CONTROL COMPONENT
HIDDEN COMMAND RELATED DATA
510
520
530
532
540
550

FIG. 5

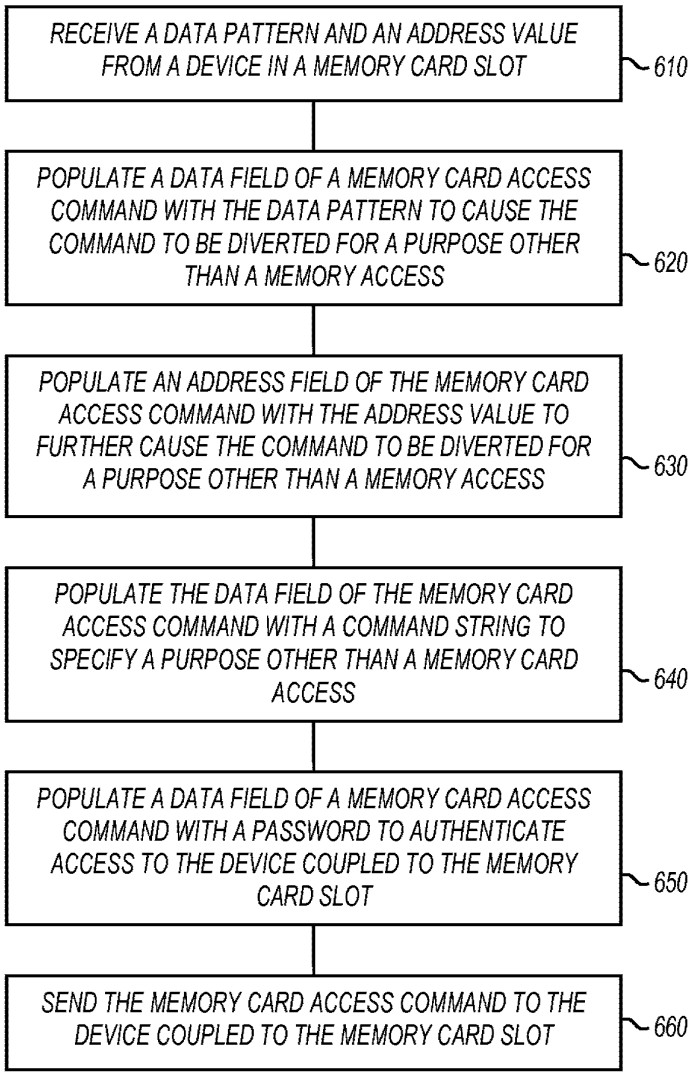

RECEIVE A DATA PATTERN AND AN ADDRESS VALUE FROM A DEVICE IN A MEMORY CARD SLOT
610
POPULATE A DATA FIELD OF A MEMORY CARD ACCESS COMMAND WITH THE DATA PATTERN TO CAUSE THE COMMAND TO BE DIVERTED FOR A PURPOSE OTHER THAN A MEMORY ACCESS
620
POPULATE AN ADDRESS FIELD OF THE MEMORY CARD ACCESS COMMAND WITH THE ADDRESS VALUE TO FURTHER CAUSE THE COMMAND TO BE DIVERTED FOR A PURPOSE OTHER THAN A MEMORY ACCESS
630
POPULATE THE DATA FIELD OF THE MEMORY CARD ACCESS COMMAND WITH A COMMAND STRING TO SPECIFY A PURPOSE OTHER THAN A MEMORY CARD ACCESS
640
POPULATE A DATA FIELD OF A MEMORY CARD ACCESS COMMAND WITH A PASSWORD TO AUTHENTICATE ACCESS TO THE DEVICE COUPLED TO THE MEMORY CARD SLOT
650
SEND THE MEMORY CARD ACCESS COMMAND TO THE DEVICE COUPLED TO THE MEMORY CARD SLOT
660
600

FIG. 6

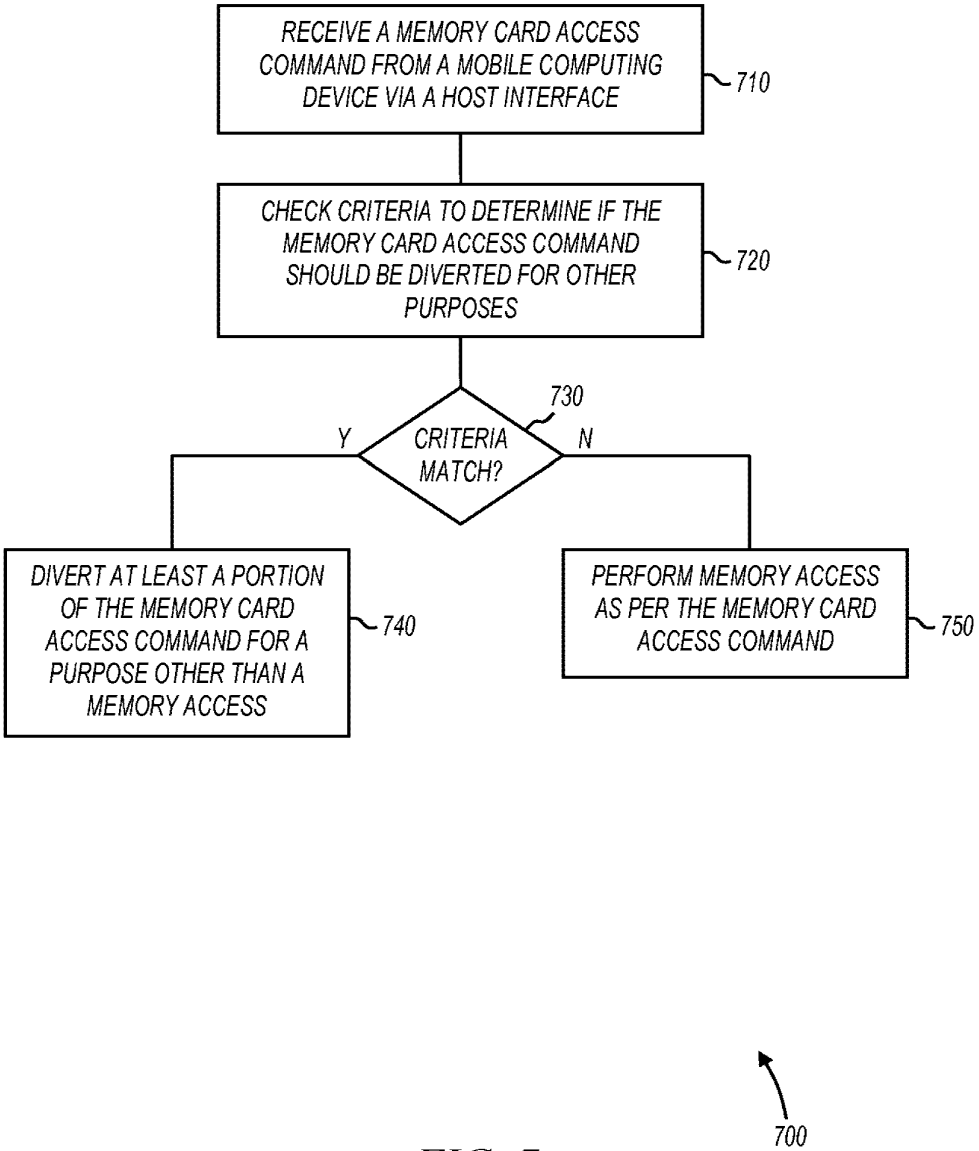

RECEIVE A MEMORY CARD ACCESS COMMAND FROM A MOBILE COMPUTING DEVICE VIA A HOST INTERFACE
710
CHECK CRITERIA TO DETERMINE IF THE MEMORY CARD ACCESS COMMAND SHOULD BE DIVERTED FOR OTHER PURPOSES
720
730
CRITERIA MATCH?
Y
N
DIVERT AT LEAST A PORTION OF THE MEMORY CARD ACCESS COMMAND FOR A PURPOSE OTHER THAN A MEMORY ACCESS
740
PERFORM MEMORY ACCESS AS PER THE MEMORY CARD ACCESS COMMAND
750
700

FIG. 7

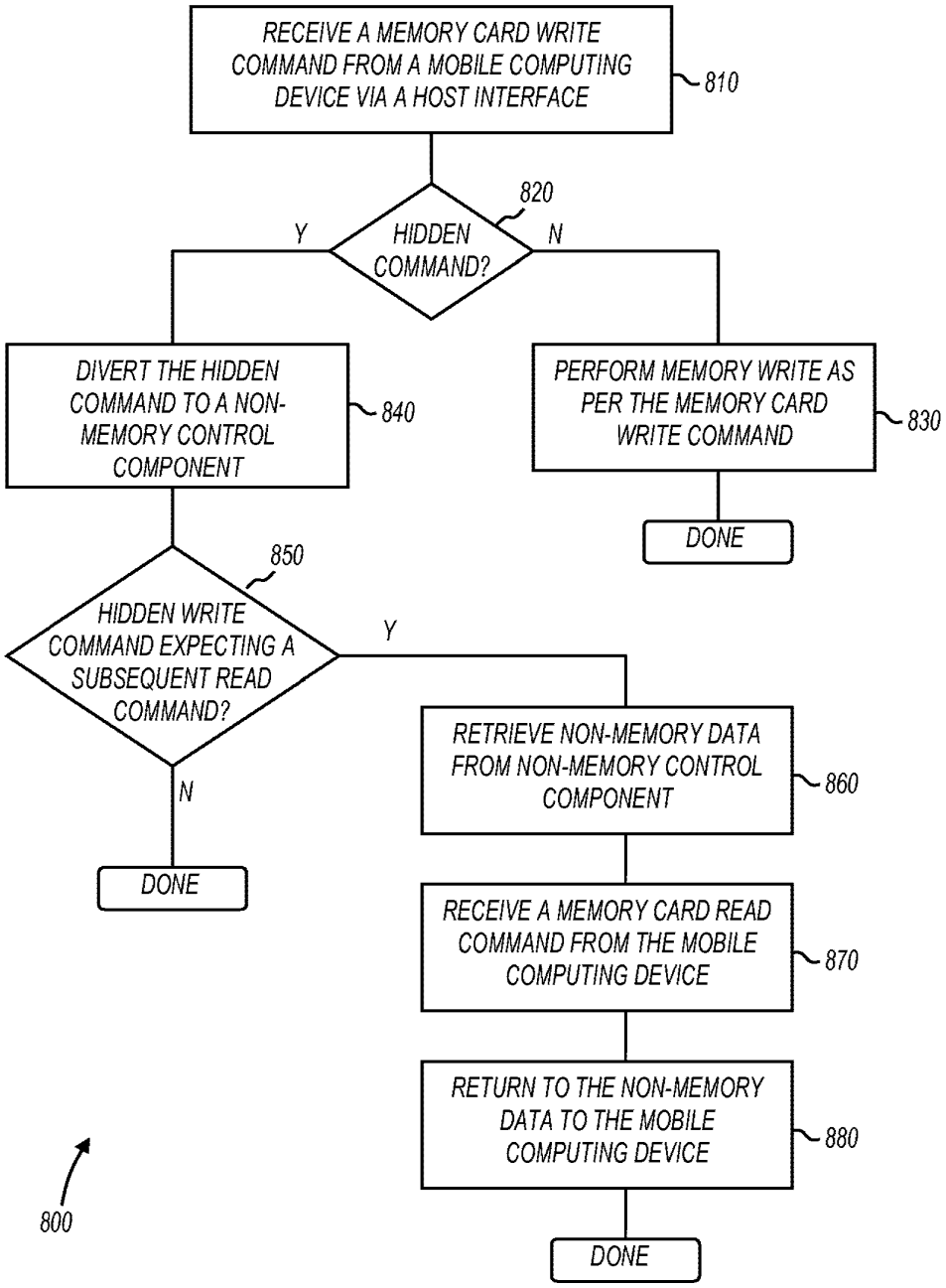

RECEIVE A MEMORY CARD WRITE COMMAND FROM A MOBILE COMPUTING DEVICE VIA A HOST INTERFACE
810
820
HIDDEN COMMAND?
Y
N
DIVERT THE HIDDEN COMMAND TO A NON-MEMORY CONTROL COMPONENT
840
PERFORM MEMORY WRITE AS PER THE MEMORY CARD WRITE COMMAND
830
DONE
850
HIDDEN WRITE COMMAND EXPECTING A SUBSEQUENT READ COMMAND?
Y
N
DONE
RETRIEVE NON-MEMORY DATA FROM NON-MEMORY CONTROL COMPONENT
860
RECEIVE A MEMORY CARD READ COMMAND FROM THE MOBILE COMPUTING DEVICE
870
RETURN TO THE NON-MEMORY DATA TO THE MOBILE COMPUTING DEVICE
880
DONE
800

FIG. 8

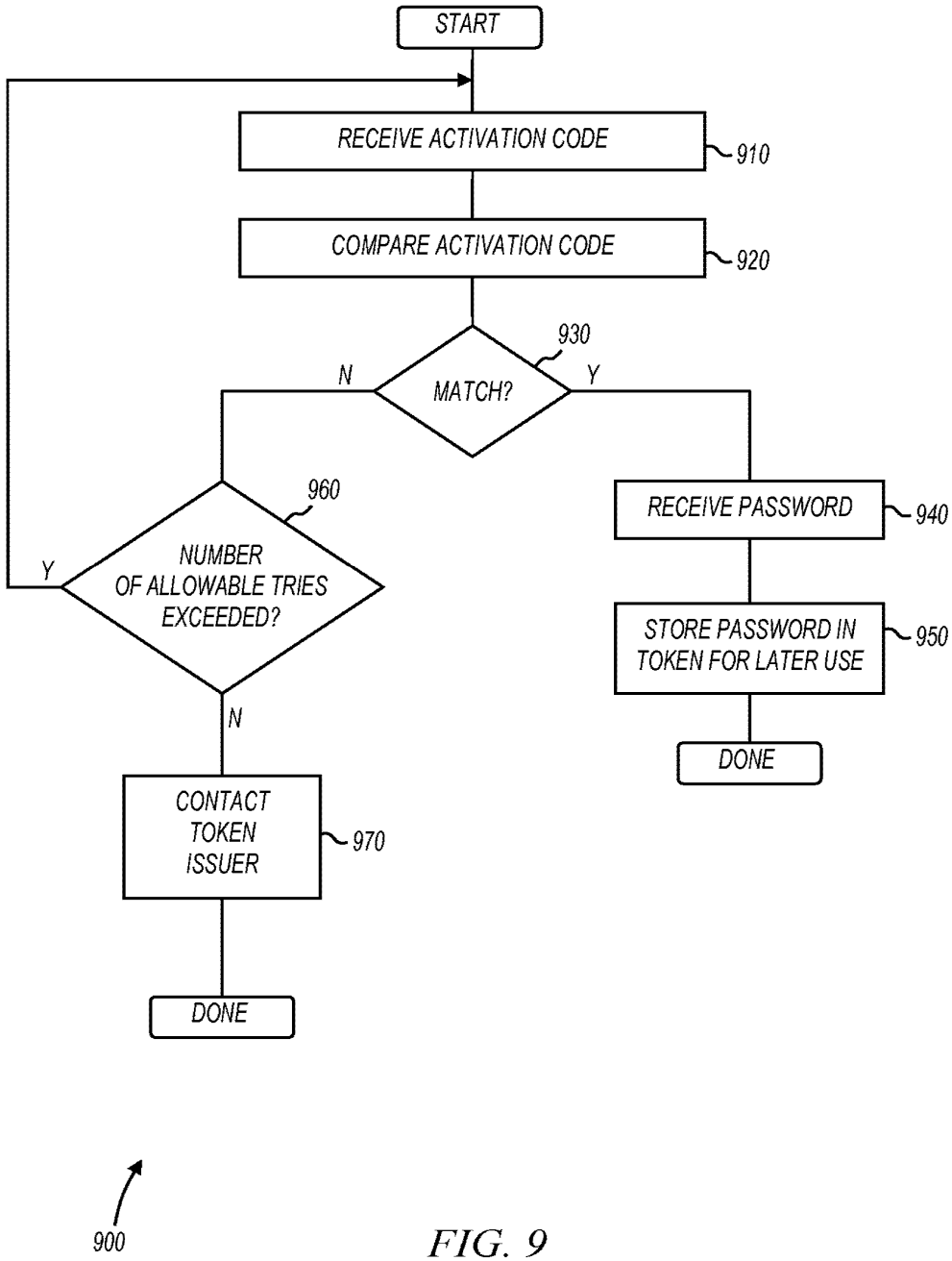

START
RECEIVE ACTIVATION CODE
910
COMPARE ACTIVATION CODE
920
930
MATCH?
N
Y
960
NUMBER OF ALLOWABLE TRIES EXCEEDED?
Y
N
RECEIVE PASSWORD
940
STORE PASSWORD IN TOKEN FOR LATER USE
950
DONE
CONTACT TOKEN ISSUER
970
DONE
900

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/57588

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 12/00 (2008.04)
USPC - 711/103
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)
USPC: 711/103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 711/100,103,159,203

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); DialogPRO; WIPO, EPO, CITESEER, Google patents, Google scholar Search Terms Used: memory card, Smart Media card, Memory Stick, PC card, Compact Flash card, Multi Media card, Secure Digital card, data field, address field, access command, write command, command, hidden, concealed, conceal, hide

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0022002 A1 (POISNER) 27 January 2005 (27.01.2005) entire document especially Fig 3A-3B, abstract, para [0008]-[0013], para [0041], para [0047]-[0053].	1-26
A	US 2004/0064612 A1 (PINTO et al.) 01 April 2004 (01.04.2004) entire document	1-26

☐ Further documents are listed in the continuation of Box C. ☐

* 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 date claimed
"T" 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
"X" 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
"Y" 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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 July 2008 (30.07.2008)	07 AUG 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

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[Continued on next page]

(54) Title: METHOD FOR STORING NFC APPLICATIONS IN A SECURE MEMORY DEVICE

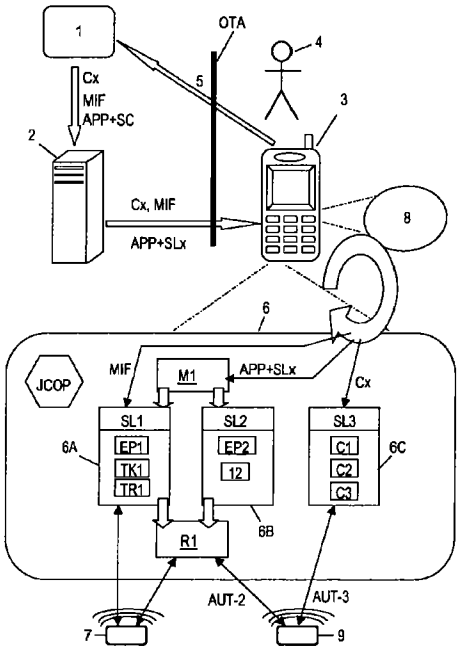


Fig. 4

(57) Abstract: A method for storing NFC applications (APP) in a secure memory device (6) having its own computational power, such as a smart card, preferably a SmartMX card, which secure memory device (6) comprises a first memory portion (6A) configured as an emulated MIFARE memory, offering a first security level (SLl), and a second memory portion (6B) accessible by means of authentication and optionally being encrypted, which second memory portion (6B) offers a second security level (SL2) which is higher than the first security level (SLl), wherein the method comprises analyzing whether the first or the second security level (SLl, SL2) is assigned to the NFC application (APP) and, depending on the results of this analysis, storing the NFC application (APP) either in the first memory portion (6A) by applying data write steps in compliance with the MIFARE standard or in the second memory portion (6B) by handling authentication routines necessary for gaining write access to said second memory portion (6B) and carrying out the write operation.

WO 2009/147548 A2

OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

Method for storing NFC applications in a secure memory device

FIELD OF THE INVENTION

The invention relates to a method for storing NFC applications in a secure memory device.

The invention further relates to a computer program product directly loadable into the memory of a secure memory device having its own computational power.

The invention further relates to a secure memory device with an arithmetic-logic unit and a memory.

The invention further relates to a mobile communication device, preferably an NFC mobile phone.

BACKGROUND OF THE INVENTION

The MIFARE® classic family, developed by NXP Semiconductors is the pioneer and front runner in contactless smart card ICs operating in the 13.56 MHz frequency range with read/write capability. MIFARE® is a trademark of NXP Semiconductors. MIFARE complies with ISO14443 A, which is used in more than 80% of all contactless smart cards today. The technology is embodied in both cards and card reader devices. MIFARE cards are being used in an increasingly broad range of applications (including transport ticketing, access control, e-payment, road tolling, and loyalty applications). MIFARE Standard (or Classic) cards employ a proprietary high-level protocol with a proprietary security protocol for authentication and ciphering. MIFARE® technology has become a standard for memory devices with key-protected memory sectors. One example for a published product specification of MIFARE® technology is the data sheet "MIFARE® Standard Card IC MF1 IC S50 - Functional Specification" (1998) which is herein incorporated by reference. MIFARE® technology is also discussed in: Klaus Finkenzeller, "RFID Handbuch", HANSER, 4th edition (2006).

The MIFARE Classic cards are fundamentally just memory storage devices, where the memory is divided into sectors and blocks with simple security mechanisms for access control. Each device has a unique serial number. Anticollision is provided so that several cards in the field may be selected and operated in sequence.

The MIFARE Standard 1k offers about 768 bytes of data storage, split into 16 sectors with 4 blocks of 16 bytes each (one block consists of 16 bytes); each sector is protected by two different keys, called A and B. They can be programmed for operations like reading, writing, increasing value blocks, etc.. The last block of each sector is called "trailer", which contains two secret keys (A and B) and programmable access conditions for each block in this sector. In order to support multi-application with key hierarchy, an individual set of two keys (A and B) per sector (per application) is provided.

The memory organization of a MIFARE Standard 1k card is shown in Fig. 1. The 1024 X 8 bit EEPROM memory is organized in 16 sectors with 4 blocks of 16 bytes each. The first data block (block 0) of the first sector (sector 0) is the manufacturer block which is shown in detail in Fig. 2. It contains the serial number of the MIFARE card that has a length of four bytes (bytes 0 to 3), a check byte (byte 4) and eleven bytes of IC manufacturer data (bytes 5 to 15). The serial number is sometimes called MIFARE User IDentification (MUID) and is a unique number. Due to security and system requirements the manufacturer block is write protected after having been programmed by the IC manufacturer at production. However, the MIFARE specification allows to change the serial number during operation of the MIFARE card, which is particularly useful for MIFARE emulation cards like SmartMX cards.

SmartMX (Memory eXtension) is a family of smart cards that have been designed by NXP Semiconductors for high-security smart card applications requiring highly reliable solutions, with or without multiple interface options. Key applications are e-government, banking / finance, mobile communications and advanced public transportation.

The ability to run the MIFARE protocol concurrently with other contactless transmission protocols implemented by the User Operating System enables the combination of new services and existing applications based on MIFARE (e.g. ticketing) on a single Dual Interface controller based smart card. SmartMX cards are able to emulate MIFARE Classic devices and thereby makes this interface compatible with any installed MIFARE Classic infrastructure. The contactless interface can be used to communicate via any protocol, particularly the MIFARE protocol and self defined contactless transmission protocols. SmartMX enables the easy implementation of state-of-the-art operating systems and open platform solutions including JCOP (the Java Card Operating System) and offers an optimized feature set together with the highest levels of security. JCOP is an IBM® implementation of the Java Card 2.2.1 and Global Platform 2.1.1 basic specifications. JCOP handles different applications which are called applets, e.g. credit card applications. JCOP provides

authentication and encryption mechanisms. SmartMX incorporates a range of security features to counter measure side channel attacks like DPA, SPA etc.. A true anticollision method (acc. ISO/IEC 14443-3), enables multiple cards to be handled simultaneously.

It should be noted that the emulation of MIFARE Classic cards is not only restricted to SmartMX cards, but there may also exist other present or future smartcards being able to emulate MIFARE Classic cards.

Recently, mobile communication devices have been developed which contain smart cards like SmartMX cards. These mobile communication devices comprise e.g. mobile phones with Near Field Communication (NFC) capabilities, but are not limited to mobile phones.

In February 2007 the GSM Assocation (GSMA) published a white paper outlining operator community guidance for the eco-system parties involved in the development of Mobile NFC (Near Field Communication) services. Mobile NFC is defined as the combination of contactless services with mobile telephony, based on NFC technology. The mobile phone with a hardware-based secure identity token (the UICC) can provide the ideal environment for NFC applications. The UICC can replace the physical card thus optimising costs for the Service Provider, and offering users a more convenient service. Various different entities are involved in the Mobile NFC ecosystem. These are defined below:

- **Customer** – uses the mobile device for mobile communications and Mobile NFC services. The customer subscribes to an MNO and uses Mobile NFC services.
- **Mobile Network Operator (MNO)** – provides the full range mobile services to the Customer, particularly provides UICC and NFC terminals plus Over The Air (OTA) transport services.
- **Service Provider (SP)** – provides contactless services to the Customer (SPs are e.g. banks, public transport companies, loyalty programs owners etc.).
- **Trusted Service Manager (TSM)** – securely distributes and manages the Service Providers' services to the MNO customer base.

It should be mentioned that the Trusted Service Manager provides a single point of contact for the Service Providers to access their customer base through the MNOs and manage the secure download and life-cycle management of the Mobile NFC application on

behalf of the Service Providers. Depending on the national market needs and situations, the TSM can be managed by one MNO, a consortium of MNOs, or by independent Trusted Third Parties. The number of operating TSMs in one market will depend on the national market needs and circumstances.

NFC mobile phones equipped with smart cards such as SmartMX cards that comprise JCOP functionality and emulated MIFARE functionality are more and more used for ticketing, access controls, coupons, payment cards and so on. The main focus of these NFC mobile phones is the Over the Air (OTA) service provisioning of the above mentioned applications. Said applications are issued by service providers. When a service provider wants to install a new service (ticketing, access control and so on), he has two options:

- He uses the MIFARE part of the smart card which is an easy-to-access technology, but provides only a basic level of security.
- He uses the JCOP part which offers a high level of security but requires a high level of special knowledge to deal with.

Hence, there is still a need to provide easier yet very secure access to smart cards like SmartMX cards relieving the service provider from requiring special skills and knowledge about JCOP to use the very secure JCOP part of the smart cards.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a method of the type defined in the opening paragraph and a device of the type defined in the second paragraph, in which the disadvantages defined above are avoided.

In order to achieve the object defined above, with a method according to the invention characteristic features are provided so that a method according to the invention can be characterized in the way defined below, that is:

A method for storing NFC applications in a secure memory device having its own computational power, such as a smart card, preferably a SmartMX card, which secure memory device comprises a first memory portion configured as an emulated MIFARE memory, offering a first security level, and a second memory portion accessible by means of authentication and optionally being encrypted, which second memory portion offers a second security level which is higher than the first security level, wherein the method comprises analyzing whether the first or the second security level is assigned to the NFC application and, depending on the results of this analysis, storing the NFC application either in the first memory portion by applying data write steps in compliance with the MIFARE standard or in

the second memory portion by handling authentication routines necessary for gaining write access to said second memory portion and carrying out the write operation.

In order to achieve the object defined above, with a computer program product according to the invention characteristic features are provided so that a computer program product according to the invention is directly loadable into the memory of a secure memory device having its own computational power, comprising software code portions for performing the steps of a method according to the invention, when said product is run on the secure memory device.

In order to achieve the object defined above, a secure memory device according to the invention comprises an arithmetic-logic unit and a memory and processes the computer program product according to the above paragraph.

In order to achieve the object defined above a mobile communication device, preferably an NFC mobile phone is provided being equipped with a secure memory device according to the above paragraph.

The characteristic features according to the invention provide the advantage that a user who wants to make use of the various different security levels provided in the secure memory device does not need to have specific knowledge of how to gain access to the different memory portions. This is particularly important when the secure memory device is operated under a highly sophisticated operating system like JCOP.

The aspects defined above and further aspects of the invention are apparent from the exemplary embodiment to be described hereinafter and are explained with reference to this exemplary embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in more detail hereinafter with reference to an exemplary embodiment. However, the invention is not limited to this exemplary embodiment.

Fig. 1 shows the memory organization of a MIFARE Standard 1k EEPROM.

Fig. 2 shows the manufacturer block of a MIFARE memory.

Fig. 3 shows the sector trailer of a sector of MIFARE memory.

Fig. 4 shows a schematic diagram of a telecommunication system including a mobile communication device with a smart card configured as a SmartMX card.

DESCRIPTION OF EMBODIMENTS

Fig. 4 shows a schematic diagram of a telecommunication system in accordance with the above referenced white book of the GSM Association (GSMA) about an eco-system for Mobile NFC (Near Field Communication) services. The telecommunication system comprises a service provider 1, a trusted service manager 2 and a mobile communication device 3. It should be observed that the numbers of service providers 1, trusted service managers 2 and mobile communication devices 3 are in no way limited. A user 4 of the mobile communication device 3 can electronically communicate (arrow 5) with the service provider 1 either by means of his mobile communication device 3 via the Over-the-Air (OTA) services provided by a mobile network operator, particularly via Short Message Service (SMS) services, and/or via a computer network. Communication between the user 4 and the service provider 1 comprises for instance ordering of NFC services like tickets etc.

The trusted service manager 2 communicates with the mobile communication device 3 via an Over-The-Air service of a mobile network operator, e.g. Short Message Service.

The service provider 1 communicates with the trusted service manager 2 via a computer network, such as the Internet, wherein the preferred data transmission protocol is HTTPS.

The mobile communication device 3 may e.g. be configured as a NFC mobile phone. The mobile communication device 3 comprises a processor (not shown in the drawing) for executing software being internally stored in the mobile communication device 3. The software comprises an operating system for carrying out and managing all functions of the mobile communication device 3.

The mobile communication device 3 is equipped with a secure memory device 6 with enhanced security features that comprises its own computational power and has multiple interface options. The secure memory device 6 is configured as a SmartMX smart card which comprises encryption coprocessors and a Java operating systems, particularly JCOP. The secure memory device 6 will be explained in more detail below. The mobile communication device 3 further comprises a trusted service client 8 which in the present embodiment of the invention is a software module being contained in the general software of the mobile communication device 3. The trusted service client 8 is controlled by the trusted service manager 2 and has the ability to manage NFC applications in the secure memory device 6. Managing NFC applications comprises installing, updating and de-installing NFC

applications. NFC applications are for instance tickets, coupons, access controls, e-purse functions, etc. which have to be handled with different levels of security.

According to the present invention, the secure memory device 6 provides different security levels for storing said NFC applications. Strictly speaking, the secure memory device 6 comprises a first memory portion 6A offering a first security level SL1. The secure memory device 6 further comprises a second memory portion 6B offering a second security level SL2 which is higher than the first security level SL1. Finally, the secure memory device 6 comprises a third memory portion 6C offering a third security level SL3 which is the highest one.

The first memory portion 6A of the secure memory device 6 is configured as an emulated MIFARE device. Access to its contents is granted by keys as has been explained in the introduction of this document. Data are written into the first memory portion 6A and read out from it according to the general MIFARE specifications. There is neither encryption nor authentication provided, but the advantage of this standard MIFARE configuration is that its access procedures can easily be handled. This first memory portion 6A is particularly useful for storing NFC applications that do not represent very high monetary values, such as a ticket TK1, a transport pass TR1, or an e-purse EP1 that represents a monetary value of less than e.g. 100 €. MIFARE applications MIF are e.g. issued by the service provider 1 and are transmitted to the trusted service manager 2. The trusted service manager 2 transmits the MIFARE application MIF via the over the air Interface (OTA) of a mobile network operator to the trusted service client 8 in the mobile communication device 3. The trusted service client 8 manages installation of the MIFARE applications MIF in the first memory portion 6A of the secure memory device 6.The contents of the first memory portion 6A of the secure memory device 6 can be read by standard MIFARE readers 7.

The configuration of the third memory portion 6C of the secure memory device 6 is based on a Java operating system, particularly JCOP, and offers highest security by providing authentication, symmetric and asymmetric encryption features. However, these features can only be used by means of so-called CARDlets which are specifically customer-tailored software modules and are based on the JCOP operating system. Consequently, any party intending to make use of these features must have an in depth knowledge of both JCOP and CARDlet programming. For instance, if a service provider 1, e.g. a ticket provider, wants to send a ticket to be stored in the third memory portion 6C of the secure memory device 6, he cannot simply transfer the ticket itself to the secure memory device 6, but he has to send a specific CARDlet C1 with its own ticket management inside in order to cope with the

specific security features of the third memory portion 6C. The service provider 1 himself has to develop this specific CARDlet C1. Due to the complexity of CARDlet programming, the third memory portion 6C is mainly used by credit card providers who have the manpower and resources for developing their customer-tailored credit card application CARDlets C2, C3. Generally, customer tailored CARDlets Cx are sent from an issuing service provider 1 to the trusted service manager 2. The trusted service manager 2 transmits the customer tailored CARDlets Cx via the over the air interface (OTA) of a mobile network operator to the trusted service client 8 in the mobile communication device 3. The trusted service client 8 installs the CARDlets Cx in the third memory portion 6C of the secure memory device 6. It should be noticed, that the described configuration of the third memory portion 6C is already state of the art and there are readers 9 existing being adapted to read the contents of the third memory portion 6C of the secure memory device 6. The readers 9 have to be programmed for carrying out authentication handling procedures AUT-3.

According to the present invention, the configuration of the second memory portion 6B of the secure memory device 6 is such that it also offers highest security by providing authentication, symmetric and asymmetric encryption features. These features are also based on a Java operating system, particularly JCOP. However, in contrast to the configuration of the third memory portion 6C, a user gets access to all these security features without the necessity for having specific knowledge about JCOP and CARDlet programming. Rather, according to the present invention there is a specific management CARDlet M1 provided in the secure memory device 6 that manages all installation routines and deals with the particulars of high-level security. This means that according to the present invention a service provider 1 who wants to send an NFC application APP to the secure memory device 6 only has to send this application APP together with a security criterion SC to the trusted service manager 2. It should be emphasized, that beyond knowing the security criterion SC the service provider 1 does not have to have knowledge of how to deal with the high-level security features like authentication, symmetric and asymmetric encryption, and particularly does not need to know anything about JCOP and CARDlet programming.

The security criterion SC is e.g. either a code for the desired security level SL1, SL2, SL3, or a specific value that can be checked by the trusted service manager 2 in respect of predefined conditions. For instance, the trusted service manager 2 checks incoming e-purse applications whether they have a monetary value of e.g. less than 100 €. If this condition is met, then the trusted service manager 2 will e.g. assign the security level SL1 to

this e-purse application, otherwise he will assign the higher security level SL2 to this e-purse application.

Next, the trusted service manager 2 transmits the NFC application APP together with the assigned security level SLx (x = 1 or 2) via the over the air interface OTA of a mobile network operator to the trusted service client 8 residing in the mobile communication device 3. The trusted service client 8 hands the NFC application APP together with the assigned security level SLx over to the specific management CARDlet M1 in the secure memory device 6. The specific management CARDlet M1 analyses which security level SLx is assigned to the NFC application APP.

If the first security level SL1 is assigned to the NFC application APP then the specific management CARDlet M1 will store the NFC application APP in the first memory portion 6A in accordance with the standard MIFARE specifications.

If the second security level SL2 is assigned to the NFC application APP then the specific management CARDlet M1 will handle all necessary encryption and/or authentication steps in order to get write access to the second memory portion 6B of the secure memory device 6 and will store the NFC application APP in the second memory portion 6B. It should be mentioned that the specific management CARDlet M1 has implemented all necessary information and procedures for handling encryption and/or authentication in respect of the second memory portion 6B, but has no information to access the third memory portion 6C of the secure memory device 6.

In order to enable MIFARE reader 7 or reader 9 which is adapted for carrying out authentication AUT-2, a specific reading CARDlet R1 is provided which has read access to both the first memory portion 6A and the second memory portion 6B, such that it retrieves MIFARE applications from the first memory portion 6A and transmits them to the MIFARE reader 7 and - provided that authentication with reader 9 was successful - retrieves NFC applications from the second memory portion 6B and transmits them to the reader 9.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The indefinite article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere

fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

CLAIMS:

1. A method for storing NFC applications (APP) in a secure memory device (6) having its own computational power, such as a smart card, preferably a SmartMX card, which secure memory device (6) comprises a first memory portion (6A) configured as an emulated MIFARE memory, offering a first security level (SL1), and a second memory portion (6B) accessible by means of authentication and optionally being encrypted, which second memory portion (6B) offers a second security level (SL2) which is higher than the first security level (SL1), wherein the method comprises analyzing whether the first or the second security level (SL1, SL2) is assigned to the NFC application (APP) and, depending on the results of this analysis, storing the NFC application (APP) either in the first memory portion (6A) by applying data write steps in compliance with the MIFARE standard or in the second memory portion (6B) by handling authentication routines necessary for gaining write access to said second memory portion (6B) and carrying out the write operation.

2. The method as claimed in claim 1, wherein the secure memory device (6) is operated by means of a Java operating system, preferably JCOP.

3. A computer program product being directly loadable into the memory of a secure memory device (6) having its own computational power, comprising software code portions for performing the steps of a method according to claim 1 or 2, when said product is run on the secure memory device (6).

4. A computer program product as claimed in claim 3, wherein the computer program product is stored on a computer readable medium or is downloadable via a data connection from a remote server.

5. A computer program product as claimed in claim 3, being designed to run under a Java operating system, particularly JCOP.

6. A secure memory device (6) with an arithmetic-logic unit and a memory, wherein the secure memory device (6) is adapted to process the computer program product as claimed in claim 3.

7. The secure memory device (6) as claimed in claim 6, being configured as a smart card, preferably a SmartMX card.

8. A mobile communication device (3) comprising the secure memory device (6) as claimed in claim 7.

9. The mobile communication device (3) as claimed in claim 8, being configured as an NFC mobile phone.

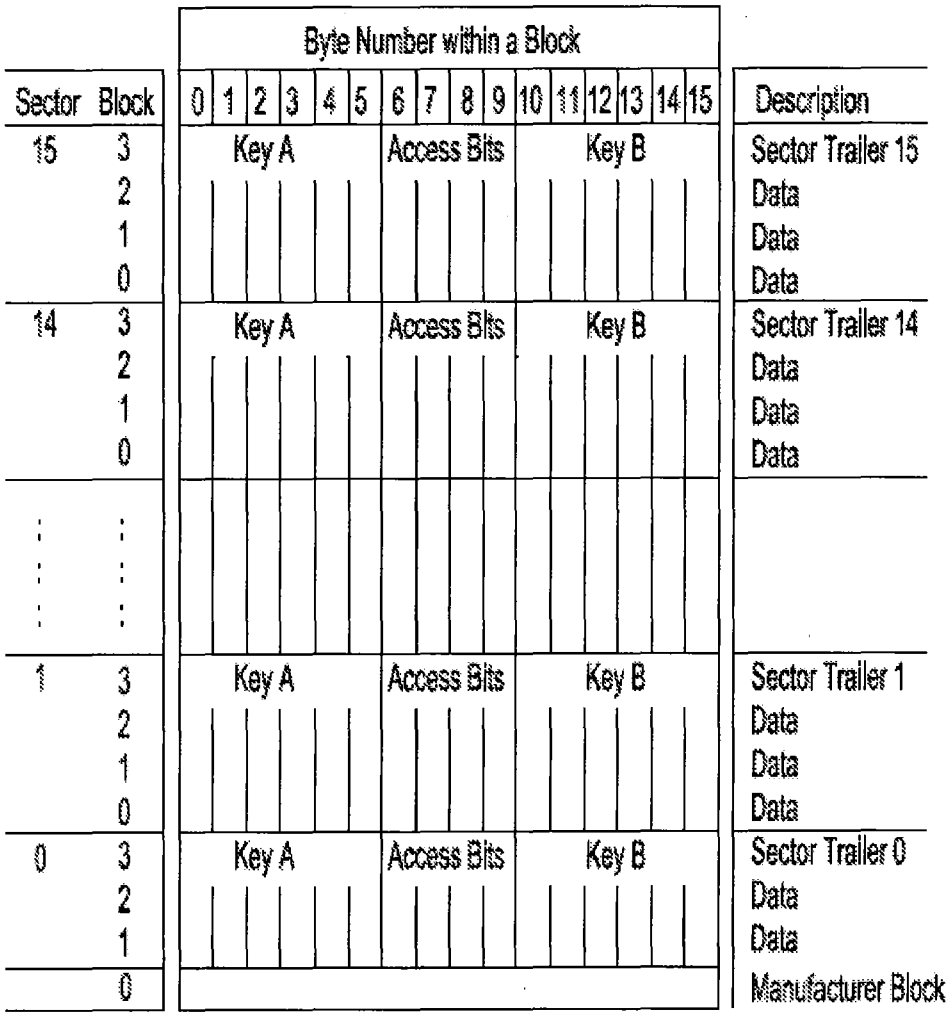


Fig. 1

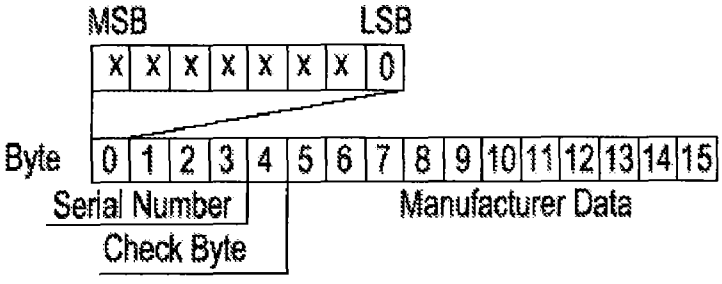


Fig. 2

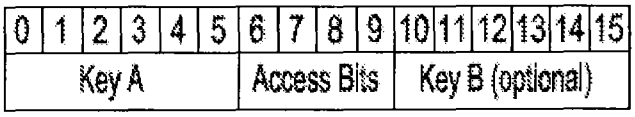


Fig. 3

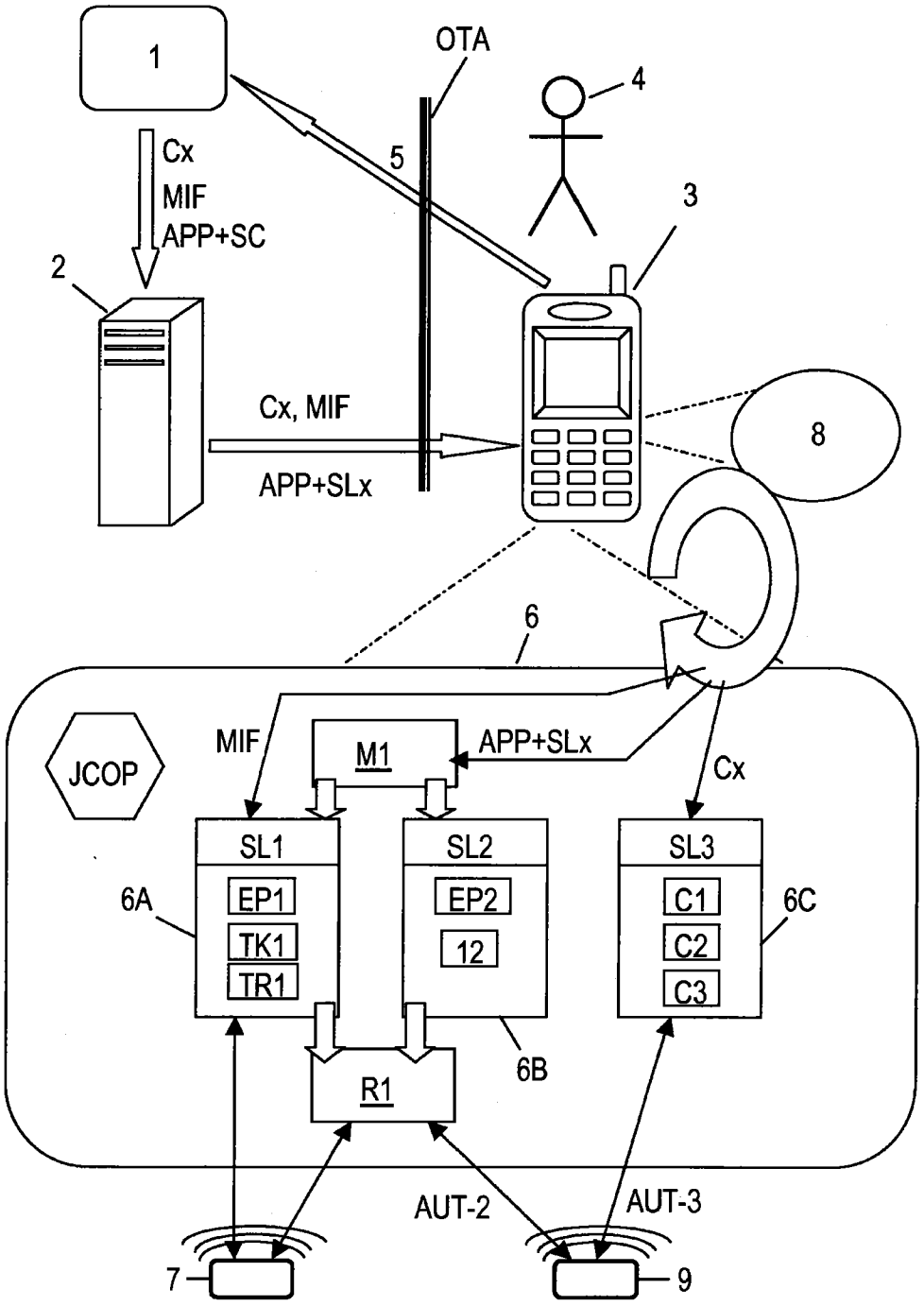

1
OTA
4
Cx
MIF
APP+SC
5
3
2
Cx, MIF
APP+SLx
8
6
JCOP
MIF
M1
APP+SLx
Cx
SL1
SL2
SL3
6A
EP1
TK1
TR1
EP2
12
C1
C2
C3
6C
6B
R1
AUT-2
AUT-3
7
9

Fig. 4

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DERWENT-WEEK: 201009

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TITLE: Near field communication application storing method for e.g. microprocessor based card in near field communication mobile phone, involves storing near field communication application in one of two memory portions of secure memory device

INVENTOR: CORDA A

PATENT-ASSIGNEE: NXP BV[NXPNN]

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APPLICATION-DATA:

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INT-CL-CURRENT:

TYPE	IPC DATE
CIPP	G06F21/02 20060101

ABSTRACTED-PUB-NO: WO 2009147548 A2

BASIC-ABSTRACT:

NOVELTY - The method involves analyzing whether security level (SL1, SL2) offered by memory portions (6A, 6B) of a secure memory device (6) e.g. smart card, is assigned to the near field communication (NFC) applications, and storing the NFC application in the memory portion (6A) by applying data write steps in compliance with MIFARE standard or in the memory portion (6B) by handling authentication routines necessary for gaining write access to the memory portion (6B) and carrying out the write operation depending on the results of the analysis.

DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) a computer program product comprising a set of

instructions to perform a method for storing near field communication applications in a secure memory device

(2) a secure memory device comprising an arithmetic-logic unit and a memory.

USE - Method for storing near field communication applications in a secure memory device e.g. smart card such as a SmartMX(RTM: Microprocessor based card) card, in a mobile communication device i.e. near field communication mobile phone (all claimed), in a telecommunication system. Uses include but are not limited to a transport ticketing application, access control application, electronic-payment application, road tolling application, loyalty application, electronic government application, banking/ finance application, mobile communication and advanced public transportation application.

ADVANTAGE - The method enables utilization of the MIFARE part of the secure memory device that provides an easy-to-access technology and Java(RTM: Object-oriented programming language) card operating system (JCOP) part that offers a high level of security, thus providing easier and very secure access to secure memory device so as to relieve the service provider from requiring special skills and knowledge about JCOP to use the very secure JCOP part of the secure memory device so as to make use of the different security levels provided in the secure memory device. The method enables storing near field communication (NFC) applications in the secure memory device in the mobile communication device with a hardware-based secure identity token so as to provide the ideal environment for NFC applications, thus replacing the physical card, and hence optimizing costs for the service provider and offering users a more convenient service.

DESCRIPTION OF DRAWING(S) - The drawing shows a schematic block diagram of a telecommunication system including a mobile communication device with a smart card configured as a SmartMX card.

Security levels (SL1,SL2)

Service provider (1)

Trusted service manager (2)

Mobile communication device (3)

Secure memory device (6)

Memory portions (6A, 6B)

CHOSEN-DRAWING: Dwg.4/4

TITLE-TERMS: FIELD COMMUNICATE APPLY STORAGE METHOD MICROPROCESSOR BASED CARD MOBILE TELEPHONE ONE TWO MEMORY PORTION SECURE DEVICE

DERWENT-CLASS: T01 T04 U14 W01

EPI-CODES: T01-F05G; T01-F07; T01-H01C2; T01-J05A1; T01-J12C; T01-J21; T01-N01A3; T01-N02B1B; T01-S03; T04-K03A; U14-A07B; W01-C01D3C;

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[Continued on next page]

(54) Title: CONTACTLESS DEVICE WITH MINIATURIZED ANTENNA

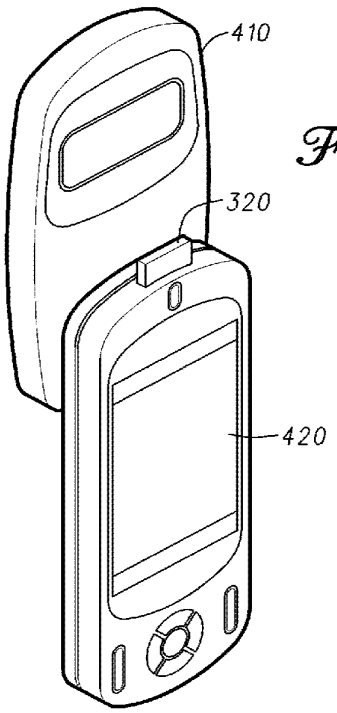


Fig. 4

(57) Abstract: A contactless device includes a miniaturized antenna. The antenna includes an inductive coupling element that presents a field coupling surface area to couple to a magnetic field. The inductive element may be made of layers where conductive loops are formed parallel to the layers or perpendicular to the layers. When conductive loops are formed perpendicular to the layers, the effective field coupling surface area is increased. The inductive element is positioned on an outside edge of a memory card compatible device with the field coupling surface area perpendicular to the card.

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CONTACTLESS DEVICE WITH MINIATURIZED ANTENNA

Related Applications

Benefit is claimed under 35 U.S.C. 119(e) to U.S. Provisional Application Ser. No. 61/155,144, entitled "Contactless Device with Miniaturized Antenna" by Narendra et al., filed February 24, 2009, which is herein incorporated in its entirety by reference for all purposes.

Field

The present invention relates generally to contactless devices, and more specifically to small contactless devices.

Background

Figures 1A, 1B, 2A and 2B show prior art. Figures 1A and 1B show antennas parallel to substrate. This is typical of credit cards that include contactless technology. Figures 2A and 2B show the prior art cards being held substantially parallel to the card reader in order to couple magnetic energy from the reader to the coil.

Brief Description of the Drawings

Figures 1A, 1B, 2A, and 2B shows prior art contactless cards and their usage;

Figure 3 shows how the prior art antenna will affect usage of a memory card;

Figure 4 shows how the prior art antenna will affect usage of a memory card when inserted in a mobile device;

Figure 5 shows placement of a miniaturized antenna on a memory card;

Figure 6 shows orientation of a miniaturized antenna on a memory card;

Figure 7 shows orientation of a memory card with respect to a reader;

Figure 8 shows orientation of a mobile device with respect to a reader;

Figure 9 shows orientation of a miniaturized antenna with respect to a magnetic field emitted from a reader;

Figure 10 shows transformer design;

Figure 11 shows a flowchart of methods in accordance with various embodiments of the present invention;

Figures 12-14 show miniaturized antennas;

Figure 15 shows dimensions of inductive coils;

Figure 16 shows a flowchart of methods in accordance with various embodiments of the present invention;

Figures 17 and 18 show inductive element layers in accordance with various embodiments of the present invention;

Figure 19 shows layers in an inductive element; and

Figures 20-23 show cross sections of inductive elements in accordance with various embodiments of the present invention.

Description of Embodiments

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, various embodiments of an invention. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described in connection with one embodiment may be implemented within other embodiments without departing from the scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled.

In the drawings, like numerals refer to the same or similar functionality throughout the several views.

Figure 3 shows how the prior art antenna will affect usage of a memory card. If a memory card 320 has a loop antenna wound parallel to the substrate, then the card will be held parallel to the reader 310 as shown.

Figure 4 shows how the prior art antenna will affect usage of a memory card when inserted in a mobile device. The field is flowing perpendicular to the reader 410. If the memory card 320 has a loop antenna wound parallel to the substrate, the mobile device 420 will be held parallel to the reader 410 as shown in Figure 4. For consumer convenience, the memory card is usually not taken out of the mobile device 420. If the mobile device 420 is held as in Figure 4, the system may not work because there are other metal regions between the memory card antenna and the reader 410. These other metal regions could be because of the memory card's holder inside the mobile device as well as the mobile device's printed circuit board (PCB) metal routing and components/solder. Accordingly, the field from the reader 410 may not reach the antenna's conducting metal since it may be absorbed by other metal regions.

Figure 5 shows placement of a miniaturized antenna on a memory card. Memory card 500 is shown with RFID tag 520, RFID antenna 540, memory 530, and various other components. The miniaturized antenna 540 is formed from an inductive device with at least one coil. The inductive device is positioned at the outer edge of the memory card 500 as shown. The memory card 500 may be any form factor including secure digital (SD), mini-SD, micro-SD, or the like.

To allow for capturing the field from the reader that is flowing perpendicular to the reader, the miniaturized antenna 540 is placed at the very edge of the memory card 500 so it is near the outer edge of the memory card slot when inserted in a mobile device.

Various embodiments of the present invention provide for manufacturing an inductive coil that is small enough to be placed at the outer edge, and placement and

orientation of the coil that allows for the field from the reader to flow into the antenna.

Figure 6 shows orientation of a miniaturized antenna on a memory card. Miniaturized antenna 540 is a three dimensional (3D) inductive coil encased in a filler material 614. The inductive device is positioned at the outer edge of the memory card as shown. The orientation of antenna 540 is such that the field from 610 couples to the 3D inductive coil of the antenna. The memory card may be any form factor including secure digital (SD), mini-SD, micro-SD, or the like.

Figure 7 shows orientation of a memory card with respect to a reader. Memory card 500 includes a miniaturized antenna at the edge of the card. See Figures 5, 6. When the antenna is positioned on memory card 500 as shown in Figure 6, the memory card 500 can be positioned perpendicular to the reader 410 as shown in Figure 7.

Figure 8 shows orientation of a mobile device with respect to a reader. When the memory card 500 of Figure 7 is inserted in the mobile device 420 of Figure 8, then the mobile device 420 may be oriented as shown. This allows the magnetic field to enter the antenna at the edge of the memory card 500 without first having to penetrate the back of the mobile device.

Figure 9 shows orientation of a miniaturized antenna with respect to a magnetic field emitted from a reader. Reader 410 emits electromagnetic energy at a particular frequency such as 13.56 MHz. As described above, the miniaturized antenna includes an inductive coil 612. The coil 612 is designed to couple as much magnetic field from reader 410 as possible.

The reader coil and the inductive coil 612 can be viewed as two coils in a transformer. The reader coil is fixed, and so coil 612 is designed as a secondary coil of the transformer coupling to the field from the reader coil (primary coil). Maximizing coupling area of the inductive coil 612 will increase the coupling between the reader coil and the antenna coil.

Figure 10 shows transformer design. The reader (primary coil of the transformer) is shown modeled with inductor L1, series resistance RL1, series

capacitance C1S, and parallel capacitance C1P. The miniaturized antenna (secondary coil of the transformer) is shown modeled with inductor L2, series resistance RL2, and parallel capacitance C2.

Transformer coupling does not lend itself well to an exact design procedure because there are so many factors which influence the degree of coupling. The geometry of the coils, the spacing between them, the core materials used, and the shielding, all have a pronounced effect on the degree of coupling attained in any design. Decreasing the spacing between the primary and secondary coils increases the coupling. Increasing the permeability of the magnetic path increases the coupling. And shielding a transformer decreases its loaded Q and has the effect of increasing the coupling.

Figure 11 shows a flowchart of methods in accordance with various embodiments of the present invention. Flowchart 1100 discusses factors to consider when designing a secondary transformer coil for use as a miniaturized antenna. At 110, it is recognized that for effective coupling, the secondary transformer coil should be strongly coupled to the reader coil, resonant at substantially 13.56 MHz, and have a high Q, but not too high since it will limit bandwidth (BW).

At 1120, it is recognized that coupling depends strongly on surface area, while inductance depends strongly on number of turns. At 1130, it is recognized that for any given value of inductance, resonance can be achieved by adjusting the value of an external capacitor.

At 1140, the surface area is chosen to maximize coupling, the number of turns in the coil is chosen to define the inductance, and width/length of wire is chosen to increase Q.

Figures 12-14 show miniaturized antennas. Figures 12 and 13 show an inductive element suitable for use as a miniaturized antenna at an outer edge of a memory card. The side view is the direction that is exposed to the magnetic field when in use. Figure 12 defines "A" as the overall length, "B" as the overall height, and "C" as the overall depth. Figure 12 also defines "D" as the length of the conductive end regions that couple the coil to the memory card. Example

dimensions when used in an SD format are A=10.4mm, B=0.7mm, C=2mm, and D=0.5mm. These dimensions are provided as examples only, and the various embodiments of the invention are not so limited. For example, an inductive element for use in a micro-SD card will generally have smaller dimensions.

Figure 14 shows the magnetic field entering the side view of the inductive element. Figure 14 also defines the field coupling surface area 1410. When installed on a board, the field coupling surface area is substantially perpendicular to the board.

The mechanical structure of the antenna occupies the three dimensions of length A, height B, and depth C. The structure includes metal 1420 for forming the coil and a filling material 1430 to occupy the remaining volume. The filling material 1430 may be a composite of magnetic material or ceramic material. The metal winding for the 3D coil is made to occupy the perimeter tracing the length and height of the antenna to form its one turn. Additional turns are accomplished by repeating the perimeter tracing along the depth with ohmic connections between immediate turns to create a continuous rectangular coil like a rectangular spring.

The field coupling surface area 1410 is the surface area along the two dimensions that form the perimeter tracing. This area couples the field from an external source (such as reader 410) to the 3D antenna coil inducing voltage and current in the 3D antenna coil.

In some embodiments, antenna 540 is placed in the memory card 500 so that the length of the coil aligns with what will be the outer edge of the memory card when it is inserted into a host device. The inner edge of the memory card is where there will be the electrical connectors for the memory card bus to connect to the memory card slot.

In some embodiments, antenna 540 is oriented so that when the memory card is inserted in a host device the field coupling surface area 1410 is in parallel to the outer surface of the host device. This orientation will make the incident field from the external source predominately 90 degrees to the field coupling surface area. In combination with the placement this orientation will enable the field

coupling surface area to be closest to the outer surface of the host, thereby maximizing the induced voltage and current in the 3D coil due to an external field source.

Figure 15 shows dimensions of inductive coils. As shown in the top view a single antenna may include multiple coils in parallel. In the example of Figure 15, M=6 coils are included with each coil having N=5.5 turns, although M and N may take on any value. The conductor length is given by 2(Ai+Bi+2w)(N-0.5)+Ai, where Ai and Bi are the inner dimensions of the coil and w is the width of the conductor. As shown in the side view, the effective coupling surface area is increased when f and w are kept small to maximize Bi.

Figure 16 shows a flowchart of design process methods in accordance with various embodiments of the present invention. At 1610, the manual winding and read distance measurements are provided. At 1620, the coupling surface area, the number of turns, and the width/length of wire are chosen. See Figure 11.

At 1630, the dimensions A, B, C, and D are given. These values are constrained by the form factor of the memory card. At 1632, Ai and Bi are maximized to maximize coupling. Referring now back to Figure 15, it is shown that the field coupling surface area is increased as Ai and Bi are increased.

At 1634, M is used to increase Q (decreasing the DC resistance) if possible. This corresponds to increasing the number M of parallel coils. See Figure 15. At 1636, N is chosen to arrive at the desired inductance, taking into account increased number of turns N will increase DC resistance and lower Q.

At 1638, the read distance is measured. The various parameters can be modified and the read distance measured in an iterative process. At 1650, the various parameters are finalized to arrive at a final design. The DC resistance, the inductance, the material, and the dimensions A, B, C, and D can be finalized. The external capacitor (see C2, Figure 10) on the printed circuit board can also be finalized given the inductance and the desired 13.56 MHz resonance.

Figures 17 and 18 show inductive element layers in accordance with various embodiments of the present invention. Layers include conductive materials and

insulating materials. Figure 17 shows a traditional method of forming a surface mount inductive element. Each layer includes a conductive loop, and the layers, when stacked, form multiple conductive loops. The minimum dimension w (Figure 15) is limited by process requirements. The inductor is mounted on the board on its "side" to expose the field coupling surface area at the outer edge of the card. In these embodiments, the layers are perpendicular to the board. Figure 18 shows an improved manufacturing method. Each layer forms only a portion of a conductive loop. For example, referring now to Figure 19, the bottom layer 1970 include traces with trace ends. Intermediate layers 1920, 1930, 1940, 1950, and 1960 include through-traces at locations to electrically contact the trace ends on the lower layer, and upper layer 1910 has at least one conductive surface trace aligned to electrically contact the conductive through-traces to form a conductive coil having at least one turn. The traces on layers 1910 and 1970 can be on either side of the substrate.

In some embodiments, the inductive elements include magnetic material such that a magnetic core is formed inside the conductive coil. Further, in some embodiments, the inductive elements include magnetic material outside the conductive coils.

Figures 20-23 show cross sections of inductive elements in accordance with various embodiments of the present invention. Figures 21 and 23 show inductive elements that are made using layers in the same plane as the field coupling surface area. Figures 21 and 22 show inductive elements that are made using layers perpendicular to the field coupling surface area. Note that the width w of the traces is smaller in the Figures 21 and 22, thereby increasing the effective field coupling surface area. The effective field coupling surface area is further increased in Figures 22 and 23 by extending the conductive traces to the end of the device.

Although the present invention has been described in conjunction with certain embodiments, it is to be understood that modifications and variations may be resorted to without departing from the scope of the invention as those skilled in the art readily understand. Such modifications and variations are considered to be within the scope of the invention and the appended claims.

What is claimed is:

1. An inductive element comprising:

a bottom surface; and

a plurality of layers substantially parallel to the bottom surface, the plurality of layers including a combination of electrically conductive material and electrically insulating material such that when bonded together the plurality of layers form at least one conductive coil having a field coupling surface area substantially perpendicular to the bottom surface.

2. The inductive element of claim 1 further comprising bonding areas on the bottom surface.

3. The inductive element of claim 1 wherein the plurality of layers include magnetic material forming a magnetic core within the at least one conductive coil.

4. A multilayer inductive coupling element comprising:

a lower layer having at least one conductive surface trace with trace ends;

at least one intermediate layer having conductive through-traces at locations to electrically contact the trace ends on the lower layer; and

an upper layer having at least one conductive surface trace aligned to electrically contact the conductive through-traces to form a conductive coil having at least one turn.

5. The multilayer inductive coupling element of claim 4 wherein the at least one intermediate layer comprises magnetic material positioned between the through-traces.

6. The multilayer inductive coupling element of claim 4 wherein the lower layer includes magnetic material positioned beyond the trace ends.

7. The multilayer inductive coupling element of claim 4 further comprising a bottom layer beneath the lower layer, the bottom layer including magnetic material to be positioned beneath the at least one conductive trace in the lower layer.

8. An electronic device comprising:

a circuit board with a memory card slot interface;

a contactless communications device affixed to the circuit board, the contactless communications device having an antenna port; and

an inductive element affixed to the circuit board and electrically coupled to the antenna port, the inductive element having a conductive coil with a field coupling surface area substantially perpendicular to the circuit board.

9. The electronic device of claim 8 wherein the inductive element comprises a multilayer surface-mount inductor.

10. The electronic device of claim 9 wherein the multilayer surface-mount inductor is formed with layers substantially parallel to the circuit board.

11. The electronic device of claim 9 wherein the multilayer surface-mount inductor is formed with layers substantially perpendicular to the circuit board.

12. The electronic device of claim 8 wherein the memory card slot interface comprises a Secure Digital (SD) compatible interface.

13. The electronic device of claim 8 wherein the memory card slot interface comprises a micro Secure Digital (SD) compatible interface.

14. The electronic device of claim 8 wherein the memory card slot interface comprises a mini Secure Digital (SD) compatible interface.

15. An apparatus comprising:

a memory card compatible substrate having at least one surface, an inner edge, and an outer edge opposite the inner edge;

electrical contacts on the at least one surface and situated along the inner edge; and

a conductive coil situated along the outer edge, the conductive coil having a field coupling surface area substantially perpendicular to the at least one surface.

16. The apparatus of claim 15 wherein:

the at least one surface includes a top surface and a bottom surface substantially parallel to each other; and

the electrical contacts are on the top surface, and the conductive coil is on the top surface.

17. The apparatus of claim 15 wherein:

the at least one surface includes a top surface and a bottom surface substantially parallel to each other; and

the electrical contacts are on the top surface, and the conductive coil is on the bottom surface.

18. The apparatus of claim 15 wherein the conductive coil comprises a multilayer surface-mount inductor.

19. The apparatus of claim 18 wherein the multilayer surface-mount inductor is formed with layers substantially parallel to the at least one surface.

20. The apparatus of claim 18 wherein the multilayer surface-mount inductor is formed with layers substantially perpendicular to the at least one surface.

21. An apparatus comprising:

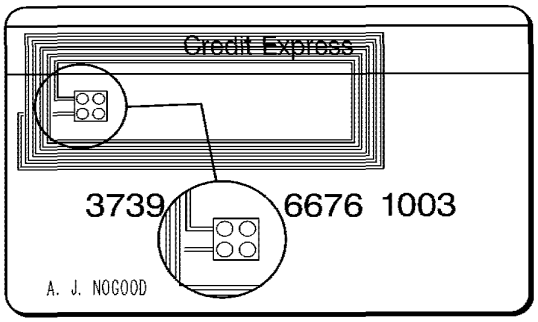
a memory card compatible substrate having at least one surface, an inner edge, and an outer edge opposite the inner edge;

electrical contacts on the at least one surface and situated along the inner edge; and

a three dimensional conductive coil situated along the outer edge.

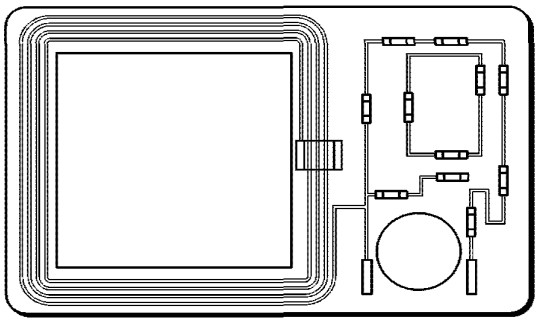
22. The apparatus of claim 21, wherein the apparatus has a micro secure digital (microSD) form factor.

23. The apparatus of claim 22 wherein the three dimensional conductive coil has a field coupling surface area substantially perpendicular to the at least one surface of the memory card.



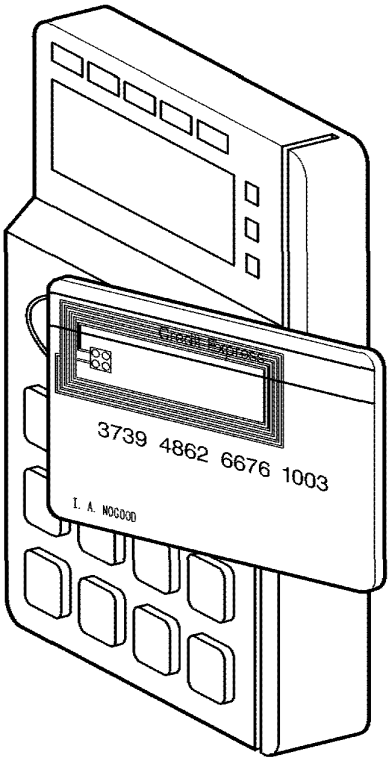
-PRIOR ART-

Fig. 1A



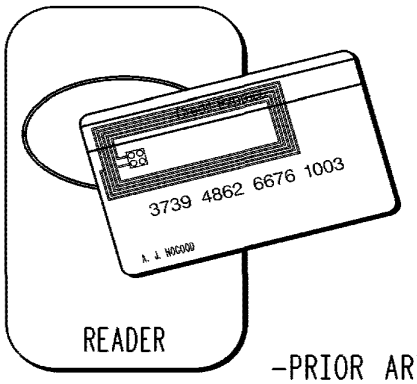
-PRIOR ART-

Fig. 1B



-PRIOR ART-

Fig. 2A



-PRIOR ART-

Fig. 2B

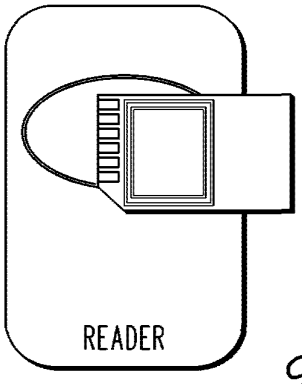


Fig. 3

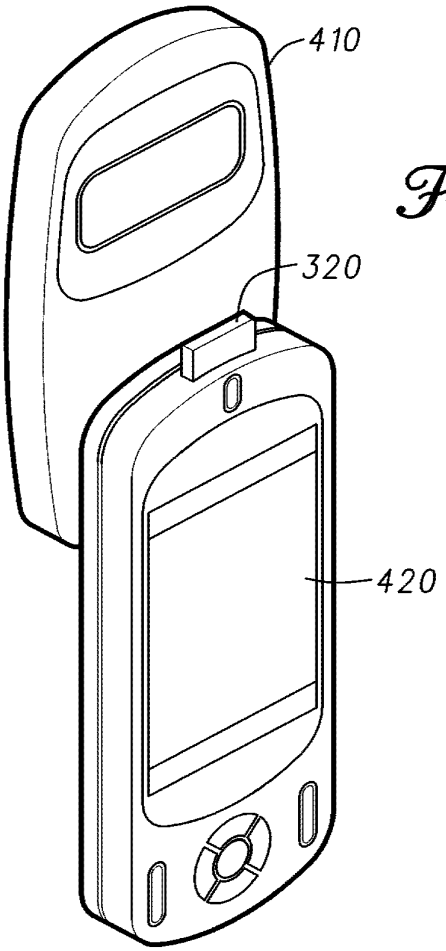


Fig. 4

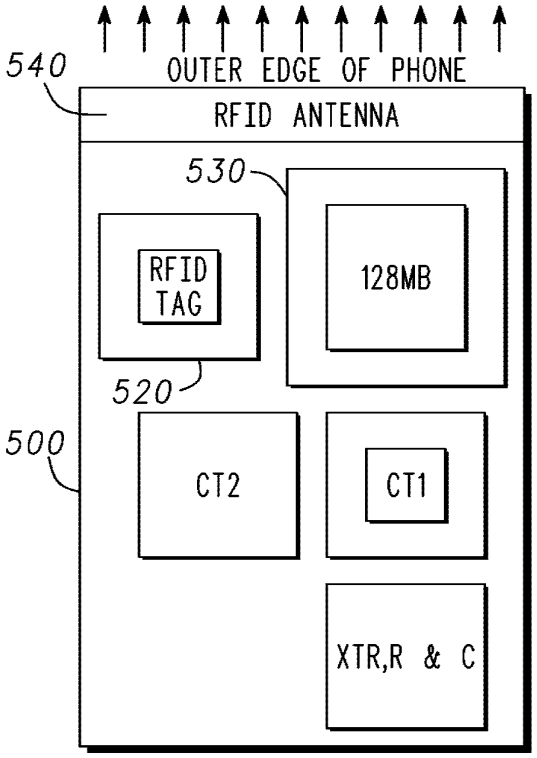


Fig. 5

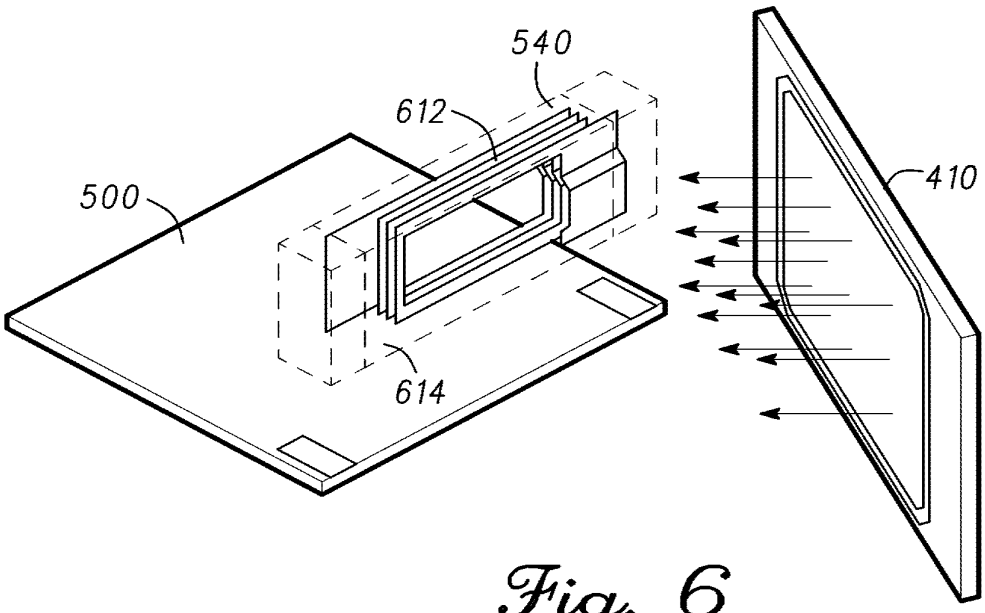


Fig. 6

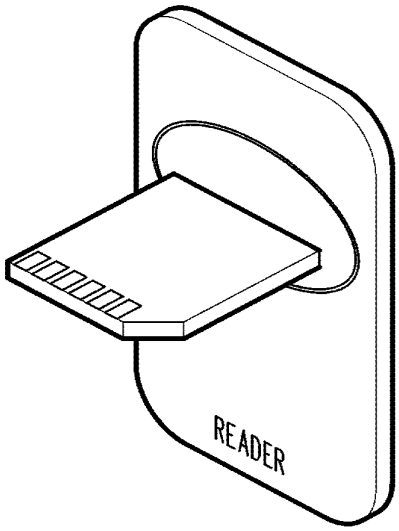


Fig. 7

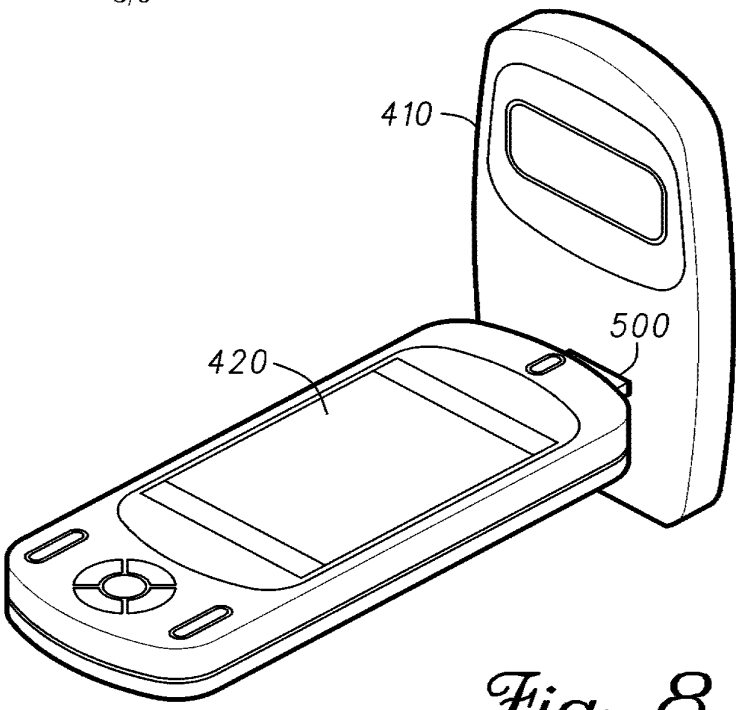


Fig. 8

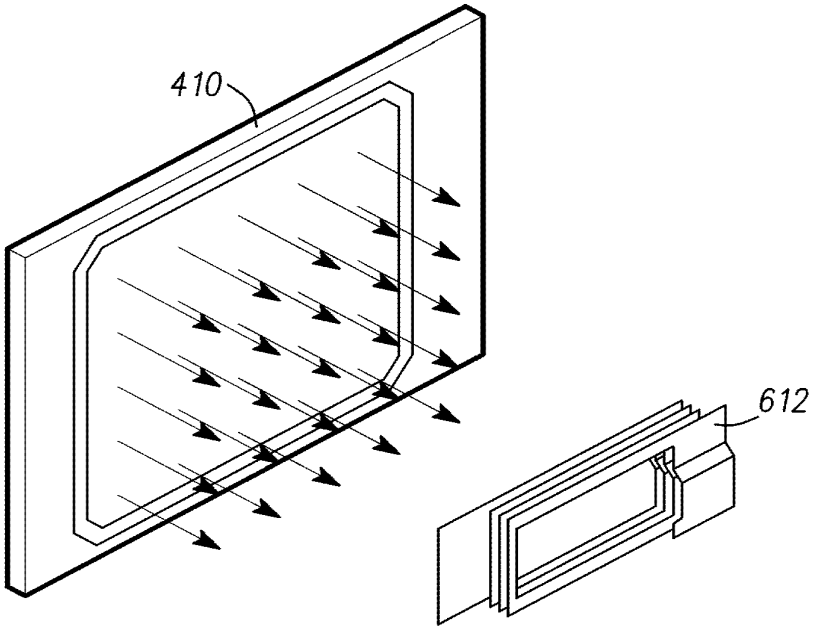


Fig. 9

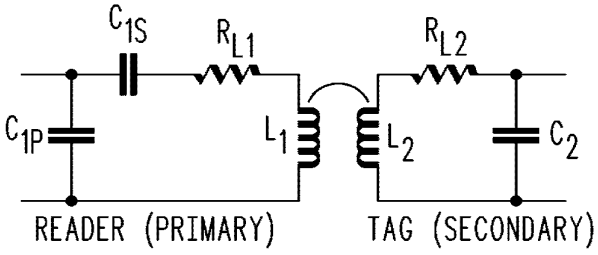


Fig. 10

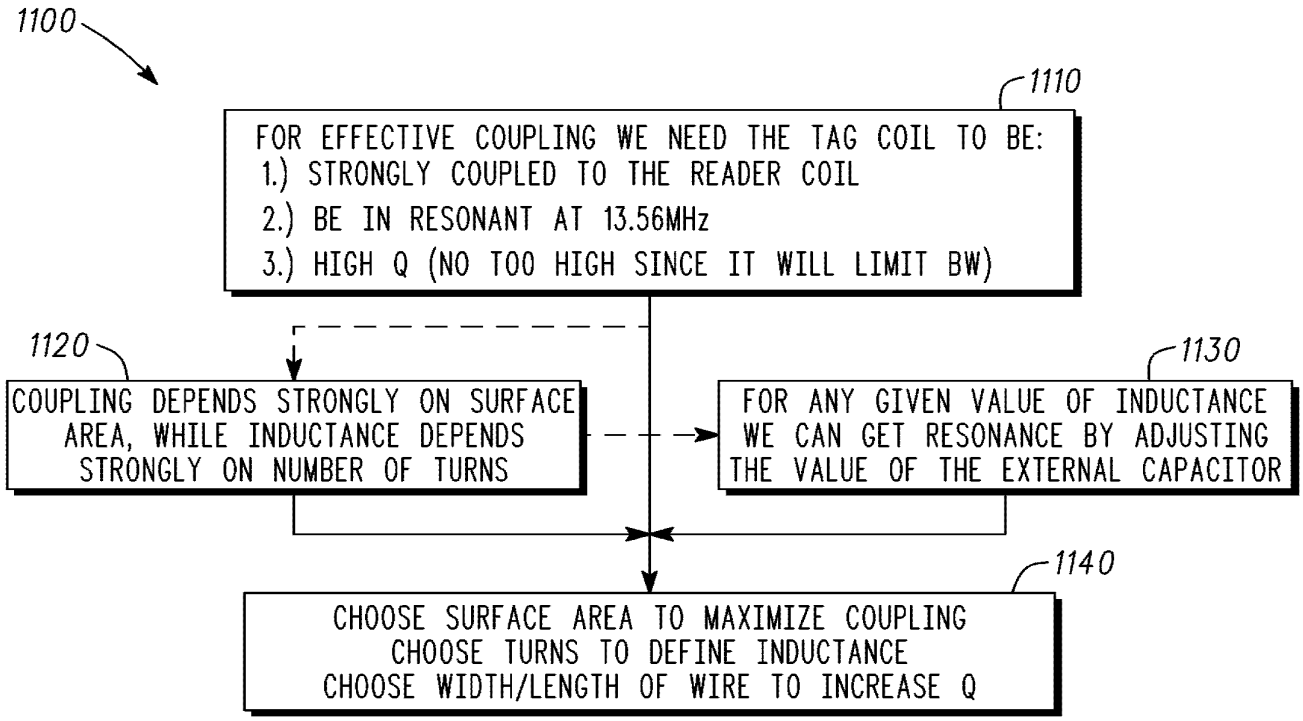


Fig. 11

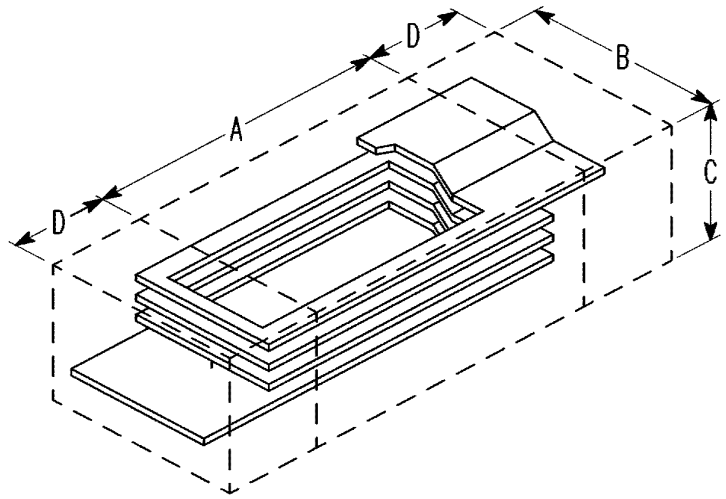


Fig. 12

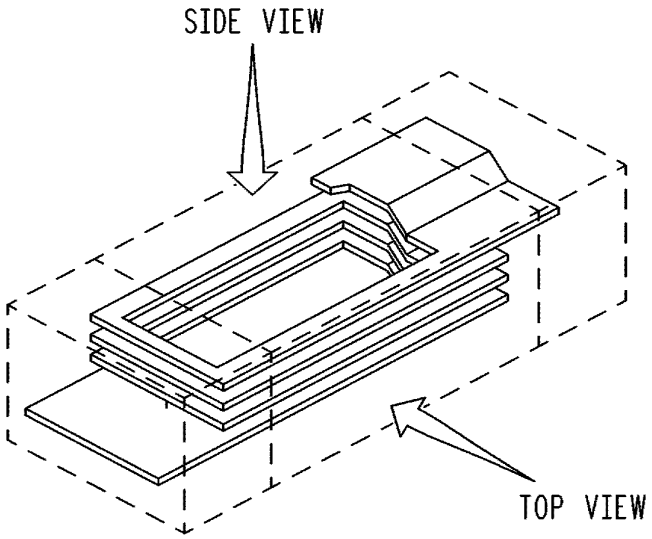


Fig. 13

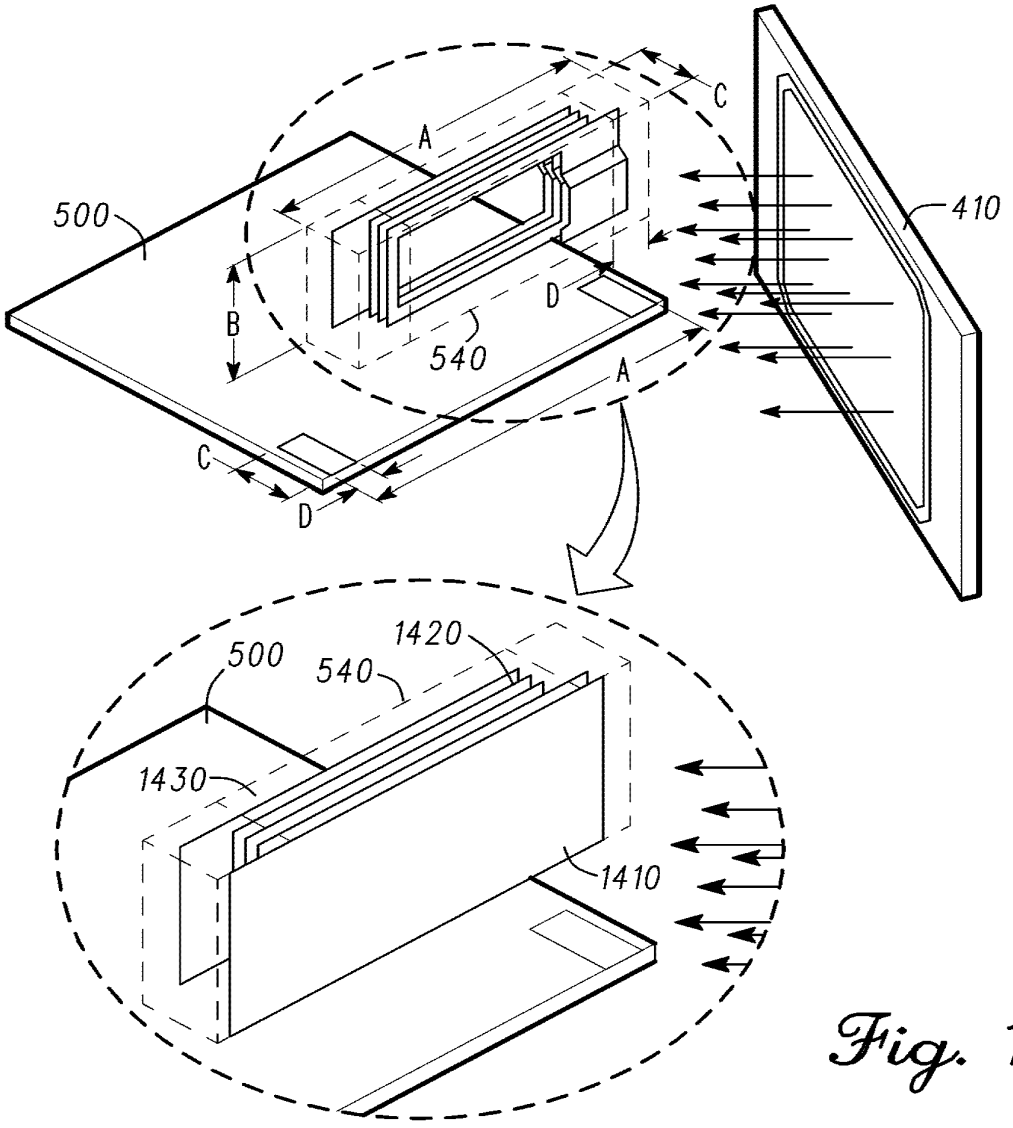


Fig. 14

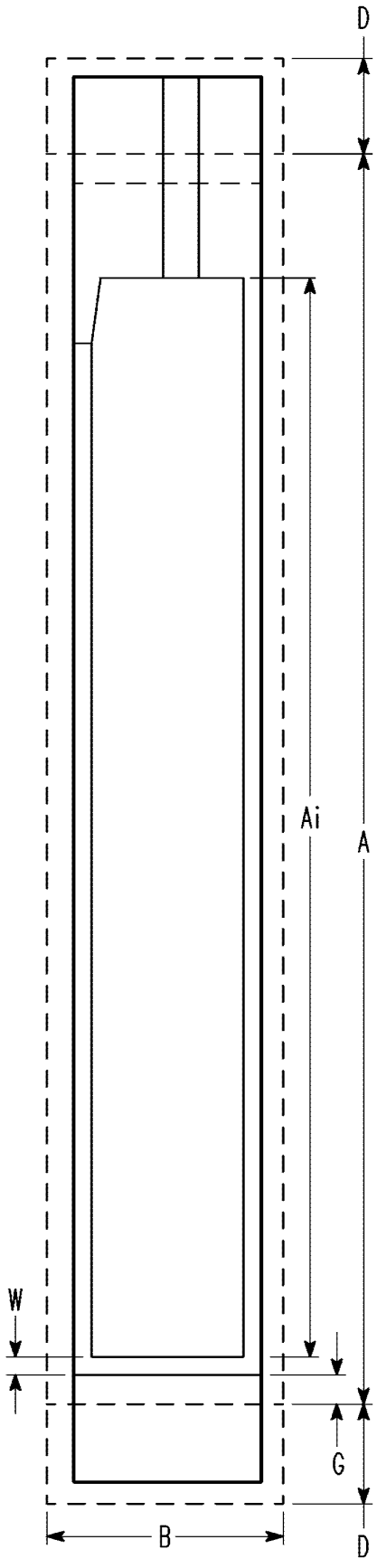


Fig. 15A

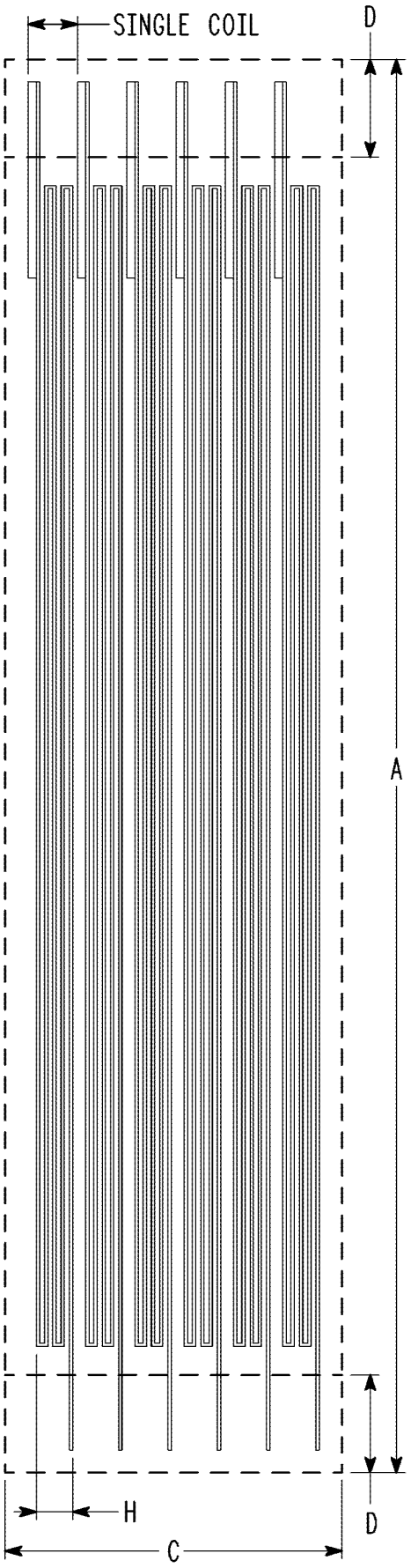


Fig. 15B

Fig. 16

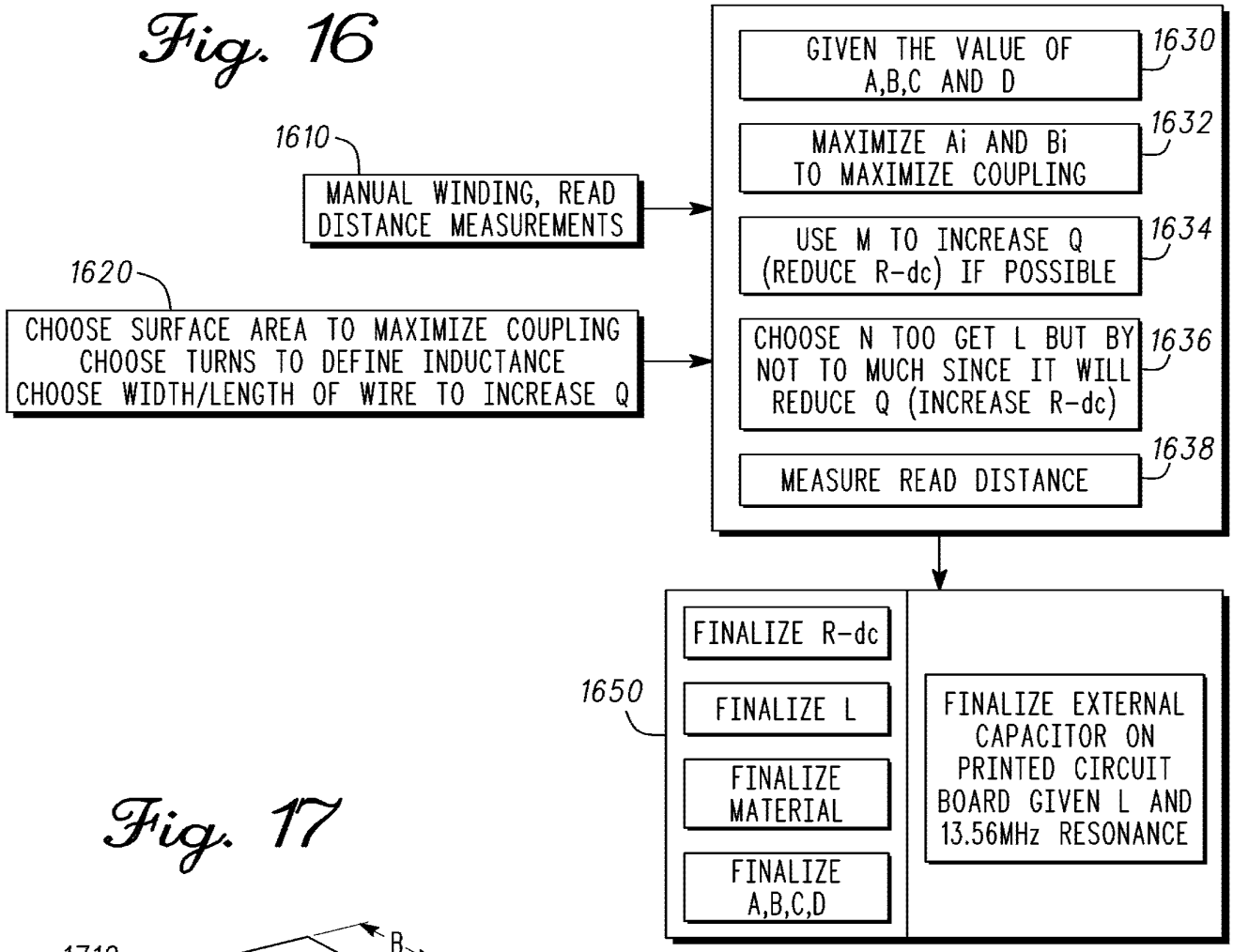
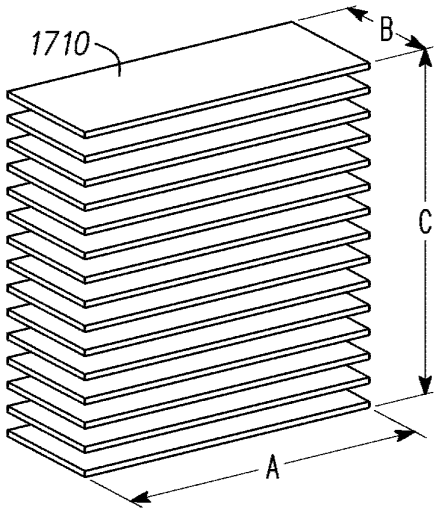


Fig. 17



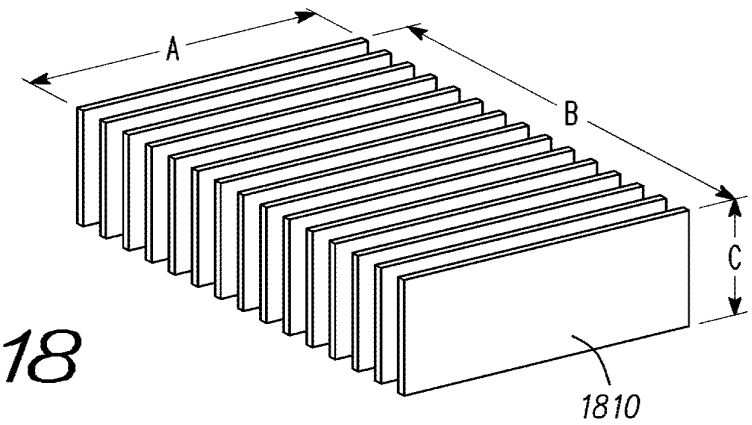


Fig. 18

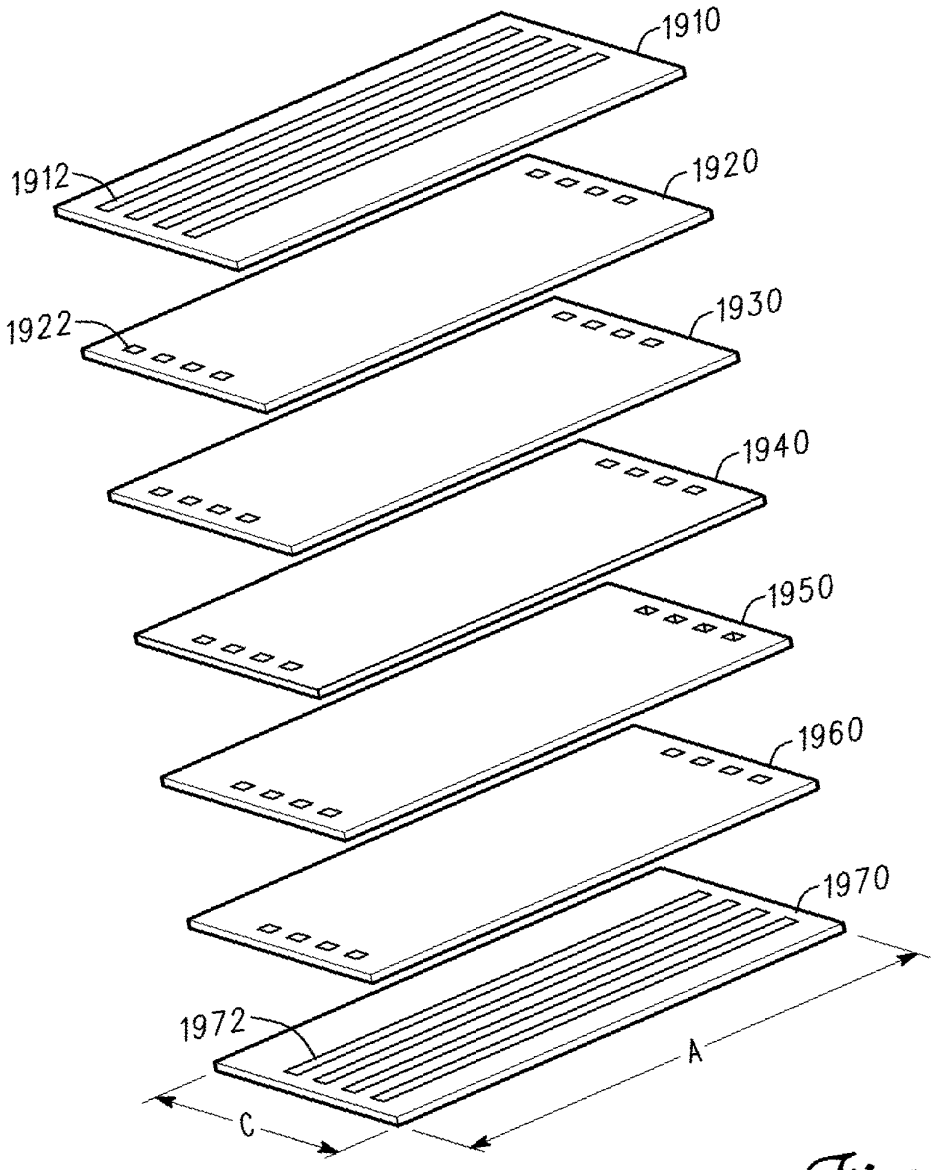


Fig. 19

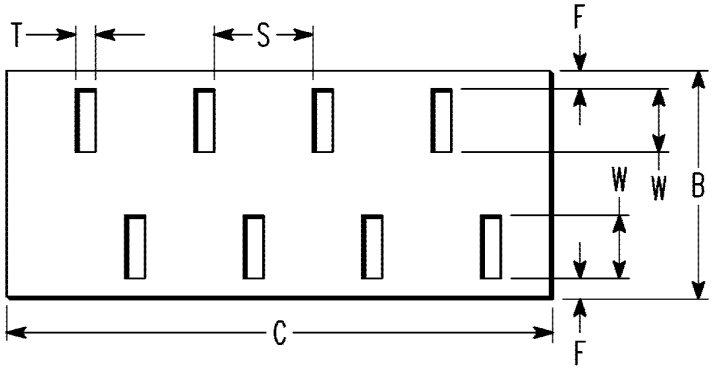


Fig. 20

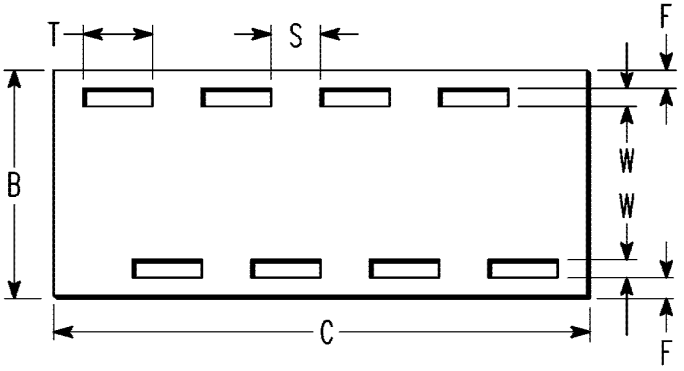


Fig. 21

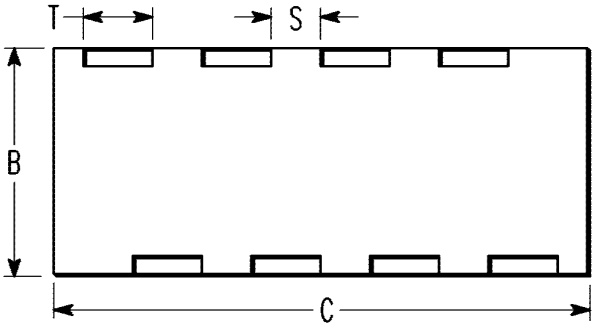


Fig. 22

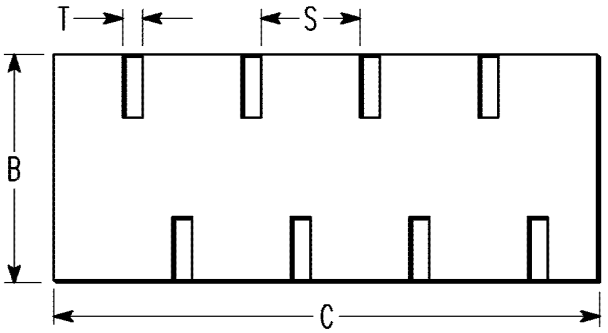


Fig. 23

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/025014

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06K 19/077 (2010.01)
USPC - 257/679
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) - B42D 15/00; G06K 19/07, 19/077 (2010.01)
USPC - 235/380, 488, 492; 257/531, 679; 361/737

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0168339 A1 (ARAI et al) 04 August 2005 (04.08.2005) entire document	1-23
A	US 2001/0002035 A1 (KAYANAKIS) 31 May 2001 (31.05.2001) entire document	1-23
A	US 6,588,660 B1 (BUESCHER et al) 08 July 2003 (08.07.2003) entire document	1-23
A	US 2007/0257797 A1 (RANCIEN et al) 08 November 2007 (08.11.2007) entire document	1-23

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270533 21 February 1995 (21.02.95) NZ

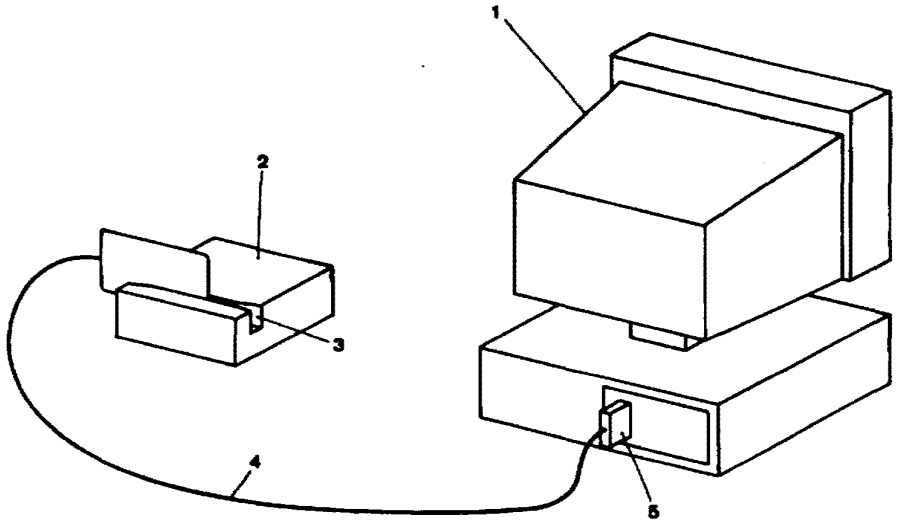
(71)(72) Applicant and Inventor: PEEK, Garry [NZ/NZ]; 24 Orr Crescent, Lower Hutt 6009 (NZ).

(74) Agents: WEST-WALKER, Gregory, James et al.; Greg West-Walker and Company, The Todd Building, 8th floor, 171-177 Lambton Quay, Wellington 6001 (NZ).

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Published
With international search report.

(54) Title: A MAGNETIC STRIPE CARD SIMULATION MEANS, SYSTEM AND METHOD



(57) Abstract

A magnetic stripe card simulation means or "test card" comprises a planar substrate component of a similar size to a magnetic stripe card and one or more small electrical coils carried by the test card such that the coil will be positioned adjacent the read head of a magnetic stripe card reader unit when the test card is inserted into the reader unit. The coils are energised to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head. The system is useful by software developers in development of software for apparatus operated by magnetic stripe cards.

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A MAGNETIC STRIPE CARD SIMULATION MEANS, SYSTEM & METHOD

FIELD OF INVENTION

The invention comprises a magnetic stripe card simulation means, system and method useful by software developers in development of software for apparatus operated by magnetic stripe cards and incorporating a magnetic stripe card reader unit, such as retail point of sale units, apparatus used in security applications, automatic teller machines or ATMs and other applications in banking and finance or similar, and useful in testing the performance or developing of such magnetic card reader units.

BACKGROUND

Magnetic stripe cards are now in everyday use. Retailers including oil companies issue cards to their customers as credit cards or preferred customer cards or similar. Banks and financial institutions issue such cards to their customers as credit cards, debit cards and cards enabling use of ATMs. Magstripe cards are also commonly used as security cards issued to persons to allow access to buildings and similar. Inevitably the use of magstripe cards in various applications will increase.

A magstripe card is typically a planar plastic card comprising a strip of magnetic media which acts as a store for data. International standards define the physical size of the card and the size and characteristics of the magnetic stripe. These standards allow for up to three tracks to be defined along the length of the magnetic stripe, each for storing data which may be programmed onto the card on issue of the card to the user by the card

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issuing authority. Typically track 1 is a read only track used to carry the customers name and account information in banking or retail applications for example. Typically track 2 is a read only track carrying data which identifies the card type, the customers account number, any personal identification number or PIN and other issuer specific data. Typically track 3 is designated a read/write track and can carry rewritable data such as customer account balances. The physical position of each track on the card is closely defined by international standards.

Magnetic card reader units generally comprise 1, 2 or 3 adjacent pick-up coils mounted in a read head assembly. The read head is mounted in the reader unit such that the coils are centered where the encoded tracks 1, 2 and 3 of a magnetic stripe card inserted into the reader will be positioned. The magnetically encoded card is passed over the read head either by a motorised transport mechanism of the reader unit or by a manual card swipe. Card guides ensure correct location of the magnetic media over the read head. As the encoded card moves past the read head, the magnetic lines of force emanating from the magnetic media of the card induce a current in the pick-up coils. This current is amplified and processed by decoding circuits to recover stored data. Tracks 1, 2 and 3 can be read simultaneously if all are used.

Each application which uses magnetic stripe card technology requires software to be produced for that application. For example, each time a retailer converts to use of magcard technology, software must be developed for use in the associated point of sale terminals of the retailer. The same is true for other magcard users such as individual banks and financial institutions, and in security card applications where magcards are used as access

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cards. Various aspects of the software development require simulation of the end use of the cards. For example, in testing new software it may be necessary to trial various card encodings, to test the system response to expired cards, to trial a range of account codes, PINs, purchase restrictions and similar. At present this is commonly carried out by encoding a number of cards with each parameter to be tested and manually swiping a card through a reader unit during the software development.

SUMMARY OF INVENTION

The present invention provides a magnetic stripe card simulation means, system and method suitable for use by developers of software for magcard applications such as those referred to above, for testing the performance of and in the development of magcard reader units, and in other related applications.

In broad terms in one aspect the invention comprises a magnetic stripe card simulation means or "test card", comprising a planar substrate component of a similar size to a magnetic stripe card, at least one electrical coil carried by the substrate component such that the coil will be positioned adjacent the read head of a magnetic stripe card reader unit when the substrate component is inserted into the reader unit, and conductors from the substrate component enabling passing of a series of electrical pulses through the coil to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head.

In broad terms in another aspect the invention comprises a magnetic stripe card simulation system, comprising:

at least one electrical coil positionable adjacent a read head, and

programmable test means connectable to said electrical coil and programmable to pass a series of electrical pulses through the coil to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head.

Preferably the electrical coil(s) is/are carried by a substrate component of a similar size to a magnetic stripe card such that the coil(s) will be positioned adjacent the read head of a magnetic stripe card reader unit when the substrate component is inserted into the reader unit.

In broad terms in a further aspect the invention comprises a method of simulation of movement of a magnetic stripe card past a read head, comprising providing at least one electrical coil positioned adjacent the read head, and passing a series of electrical pulses through the coil to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head.

DESCRIPTION OF DRAWINGS

The invention will be further described with reference to the accompanying drawings, by way of example and without intending to be limiting, wherein:

Figure 1 schematically illustrates use of a magnetic card simulation system in software development using a personal computer,

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Figure 2 shows a typical magnetic stripe card from one side showing the approximate position of the three data tracks,

Figure 3 shows a preferred form magnetic stripe card simulation means or test card of the invention,

Figure 4 shows one preferred coil design,

Figure 5 shows positioning of a test card adjacent the read head of a magstripe card reader unit when the test card is inserted into the reader unit, and

Figure 6 schematically shows the interaction between the coil(s) of a test card of the invention and the pickup coil of a magcard read head.

DETAILED DESCRIPTION OF PREFERRED FORMS

Typically, but not exclusively, the test card and simulation system of the invention will be used with a personal computer used by a software developer or similar. Figure 1 schematically shows a personal computer 1 and a magstripe card reader unit 2. The test card 3 is inserted into the reader unit as shown, and a small cable 4 connects the test card to a port of the computer via a standard plug 5, so that test software in the personal computer may energise the test card to simulate swiping of a standard magstripe card through the reader unit.

Figure 2 shows a standard magnetic stripe card. The card typically comprises a substrate 6 of standard dimensions and thickness, carrying a stripe 7 of magnetic media again in a standard position on the card. The magnetic media 7 provides three tracks in accordance with international standards, for storing data on the card. Tracks 1, 2 and 3 are indicated at T1, T2 and T3 in Figure 2.

As stated previously, track 1 is typically used as a read only track to carry a customers name and account information. Track 2 is typically used as a read only track most often used by the banking and oil industries. On track 2 the first six digits after the start sentinel are termed the card prefix and identify the card type e.g. Visa, Mastercard, Fuelcard, Debitcard, etc. The next digits give the customers account number. Together the prefix and account number make up the Primary Account Number or PAN. A separator designates the end of the PAN which may vary between 13 and 19 digits in length. The PAN separator is usually followed by the card expiry date, a PIN offset plus other issuer specific data. Track 3 is designated a read/write track and can carry rewritable data such as customer account balances (but is generally not used).

Various applications use different tracks. For example, a security access system may use only track 1 for encoding access privileges, a banking application such as EFTPOS may use only track 2 for customer account identification, and an oil industry application may use both tracks 1 and 2 using track 1 for account information and track 2 for product purchase restrictions. While three tracks are provided for by international standards at present, it is possible in the future that a larger number of tracks may be provided on a

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magnetic stripe card such as 4 or 5 tracks, and it is also possible that the data tracks may be located at other positions on the card than shown in Figure 2.

Figure 3 shows a preferred form magnetic stripe card simulation means or "test card". The test card comprises a substrate component 10 which is typically a piece of plastic or other suitable material of the same or similar dimensions to those of a standard magnetic stripe card. Where the magnetic stripe cards of a particular system do not comply with the international standards because the cards are for use with an in-house system of the card issuer who desires that the cards are of a non-standard size or that the data track(s) are in a non-standard location, the test card will also be of a non-standard size for use with the particular reader units used. Instead of a magnetic stripe, three small electrical coils 11 are carried by the substrate component 10. The coils 11 are positioned on the substrate component 10 such that they will in turn be positioned adjacent the read head of a standard magcard reader unit when the test card is inserted into the unit, as shown in Figure 1. Figure 5 shows how the small coils 11 are positioned on the substrate component 10 such that when the test card is inserted into the reader unit the coils 11 will be positioned immediately adjacent the read head 12.

In the preferred form test card shown each coil 11 is mounted in a shallow recess 13 formed in the thickness of the substrate component 10 forming the test card. For example the recesses 13 may be formed using a router. A shallow channel 14 is provided from the recesses 13 to an edge of the test card and wires pass from the coils 11 along the channel 14 to connect to a cable 15 the other end of which carries a plug for connecting the test card to the port of a personal computer for example. The coils 11 may be secured in

position in the recesses 13 as well as protected, by a resin or filler compound which also covers the wires in the channel 14. Optionally the whole surface of the card may then be covered with an adhesive film or similar. One, two or three coils may be provided depending upon the application and the number of tracks used, and it is also possible that four or more adjacent coils 11 or similar could be carried by the test card for some particular non-standard application.

The coils 11 may be small coils of any suitable configuration but in the preferred form each coil is wound such that the magnetic field generated when an electrical pulse is passed through the coil is substantially cancelled on either side of the coil in the plane of the test card to avoid detection of the magnetic field created by the coil by another read head pick up coil i.e. to avoid adjacent channel crosstalk. In the preferred form this is achieved as shown in Figure 4, by winding each coil 11 in two parts around the legs of a U-shaped core 17, the ends of which are subsequently crimped together, so that when the coil is energised a magnetic flux will radiate predominantly in directions perpendicular to the plane of the card as indicated by arrows F in Figure 4. Figure 4 shows the coil before crimping of the ends of the legs of the core together. The core 17 may be formed from permalloy sheet or other suitable coil material or alternatively the coils may be air cored. Use of a magnetic coil material increases the field strength generated. Various other coil constructions are possible however.

As stated, when the test card is inserted into a reader unit, the coils 11 are positioned adjacent the read head as shown in Figure 5. A series of electrical pulses may then be sent through each coil 11 to be picked up by the read head to create a changing magnetic field

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at the read head which simulates movement of a magnetic stripe card past the read head. Energising the coil or coils 11 with a series of pulses will simulate movement of a magstripe card comprising a number of stored data digits past the read head. Figure 6 shows the interaction of a test card coil 11 with a pickup coil 19 of the read head.

The driving current to the coils may be supplied directly from a parallel or serial port of the PC. Current limiting resistors may be provided, in the port adaptors for example, to restrict the current flow through the coils. Variable resistors may be inserted into the current path to allow adjustment of the magnetic field strength of each of the coils. Other electronic circuits may be included to limit or boost the driving current, modify its wave shape or buffer the signal. A microprocessor may be included to remove some of the processing load and time dependency from the PC.

More than one test card may be operated from the designated system port. Additional cards may be connected to the same port using appropriate adaptors and each card may be individually driven by the PC. Additional cards may be wired together in series or in parallel to operate simultaneously.

Associated software generates the pulse stream which energises the coils of the test card to simulate swiping or motorised movement of a magnetic stripe card. In the design and development of magnetic card readers and decoders the software may be arranged to energise the test card to simulate faster and slower or maximum and minimum swipe speeds, in both directions, to introduce and vary sub-integral and/or adjacent bit to bit jitter in the test signal, to vary the number of leading and trailing clock pulses, and to vary the

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magnetic field strength for example. In the development of software applications based around magnetically encoded cards various card encodings can be quickly and easily simulated to check the response of the application software during development, such as purchase limitations, expiry dates, security access levels, invalid check characters, and similar. Test cards can be stored in a card data base for easy access. In production and test centre testing of card based systems test scrips using a data base of cards can be repeatedly played. A single PC can connect to many cards simulating multiple simultaneous swipes or to test maximum system load. The swipes can be triggered from an external event to synchronise the next swipe to the availability of the card reader. The ability to simulate a card avoids having to encode real magnetic cards for each and every combination of card type.

While in the preferred form test card the coils 11 or similar are carried by a substrate component of a size the same as or similar to a standard mag stripe card, it is possible in other forms that the coils may be carried by other means enabling the coils to be placed adjacent the read head of a card reader, such as a smaller substrate strip which may be inserted into a card reader or other means insertable into a card reader to position the coils adjacent the read head.

The foregoing describes the invention including a preferred form thereof. Alterations and modifications as will be obvious to those skilled in the art are intended to be incorporated within the scope hereof, as defined in the accompanying claims.

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CLAIMS

1. A magnetic stripe card simulation means comprising a planar substrate component of a similar size to a magnetic stripe card, at least one electrical coil carried by the substrate component such that the coil will be positioned adjacent the read head of a magnetic stripe card reader unit when the substrate component is inserted into the reader unit, and conductors from the substrate component enabling passing of a series of electrical pulses through the coil to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head.

2. A magnetic stripe card simulation means according to claim 1, wherein the electrical coil(s) is/are sealed in a shallow recess or recesses in the substrate component.

3. A magnetic stripe card simulation means according to either one of claims 1 and 2 comprising two or more coils and wherein each coil is wound such that the magnetic field produced when an electrical pulse is passed through the coil is substantially cancelled on either side of the coil in the plane of the substrate component to minimise adjacent channel crosstalk.

4. A magnetic stripe card simulation means according to any one of claims 1 to 3, wherein the or each coil(s) is/are wound around a U-shaped core oriented so that the two arms of the core lie above and below each other perpendicular to the plane of the substrate component.

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5. A magnetic stripe card simulation system, comprising:

at least one electrical coil positionable adjacent a read head, and

programmable test means connectable to said electrical coil and programmable to pass a series of electrical pulses through the coil to simulate the changing magnetic field at the read head created by movement of a magnetic stripe card past the read head.

6. A magnetic stripe card simulation system according to claim 5, wherein the electrical coil(s) is/are carried by a substrate component of a similar size to a magnetic stripe card such that the coil(s) will be positioned adjacent the read head of a magnetic stripe card reader unit when the substrate component is inserted into the reader unit.

7. A magnetic stripe card simulation system according to claim 6, wherein the coil(s) is/are sealed in a shallow recess or recesses in the substrate component.

8. A magnetic stripe card simulation system according to either one of claims 6 and 7 comprising two or more coils and wherein each coil is wound such that the magnetic field produced when an electrical pulse is passed through the coil is substantially cancelled on either side of the coil in the plane of the substrate component to minimise adjacent channel crosstalk.

9. A magnetic stripe card simulation system according to any one of claims 5 to 8, wherein the or each coil(s) is/are wound around a U-shaped core oriented so that the two

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arms of the core lie above and below each other perpendicular to the plane of the substrate component.

10. A magnetic stripe card simulation system according to any one of claims 5 to 9, wherein said programmable test means is programmed to energise the coil(s) in a test regime comprising any one or more of:

a) causing the electrical pulses to simulate stored card data representative of data of actual magnetic stripe cards,

b) faster and slower series of electrical pulses representing stored card data to simulate faster and slower card movement past the read head,

c) introduction of sub-integral and/or adjacent bit-to-bit jitter into the electrical pulses representing stored card data for test purposes,

d) variations in the number of leading and trailing clock pulses in the electrical pulses simulating stored card data, and

e) variations of the amplitude of the electrical pulses to vary the magnetic field strength produced by the coil(s), for test purposes.

11. A magnetic stripe card simulation system according to any one of claims 5 to 10, wherein the programmable test means is a personal computer.

12. A method of simulation of movement of a magnetic stripe card past a read head, comprising providing at least one electrical coil positioned adjacent the read head, and passing a series of electrical pulses through the coil to simulate the changing magnetic field created by movement of a magnetic stripe card past the read head.

13. A method according to claim 12, wherein said read head is the read head of a magnetic stripe card reader unit and the electrical coil(s) is/are carried by a substrate component of a similar size to a magnetic stripe card such that the coil(s) will be positioned adjacent the read head when the substrate component is inserted into the reader unit.

14. A method according to either one of claims 12 and 13 including energising said coil in a test regime comprising any one or more of:

a) causing the electrical pulses to simulate stored card data representative of a real magnetic stripe card,

b) faster and slower series of electrical pulses representing stored card data to simulate faster and slower card movement past the read head,

c) introduction of sub-integral and adjacent bit-to-bit jitter into the electrical pulses representing stored card data for test purposes,

d) variations in the number of leading and trailing clock pulses in the electrical pulses simulating stored card data, and

e) variations of the amplitude of the electrical pulses to vary the magnetic field strength produced by the coil(s), for test purposes.

15. A magnetic stripe card simulation means substantially as described herein with reference to Figs 3 and 4 of the accompanying drawings.

16. A magnetic stripe card simulation system substantially as described herein.

17. A method of simulating movement of a magnetic stripe card past a read head substantially as described herein.

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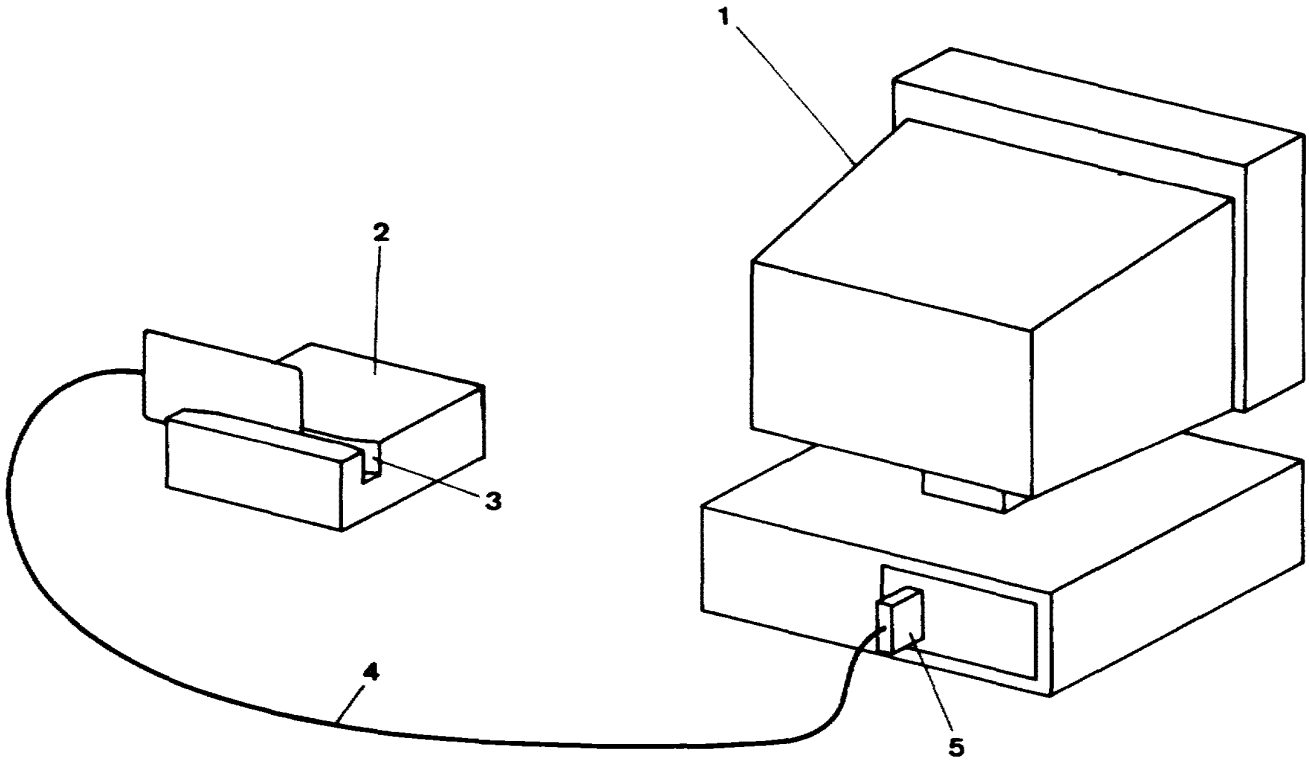


Figure 1

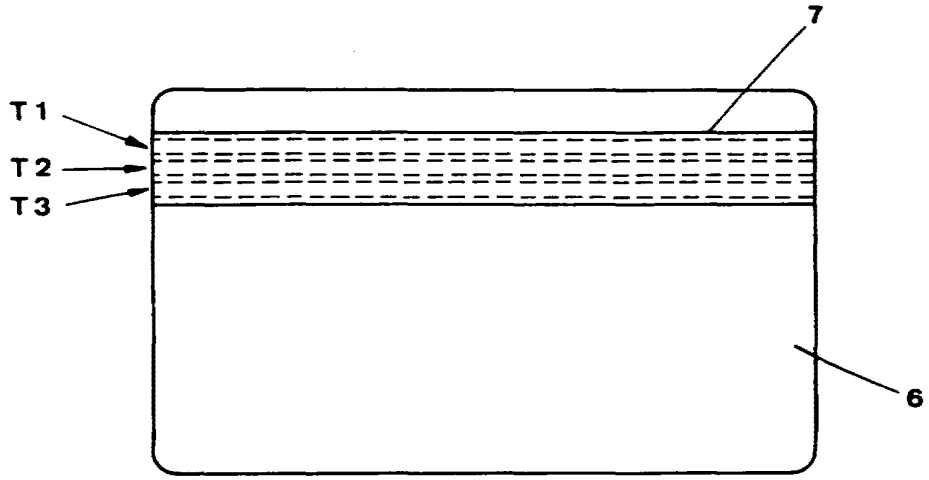


Figure 2

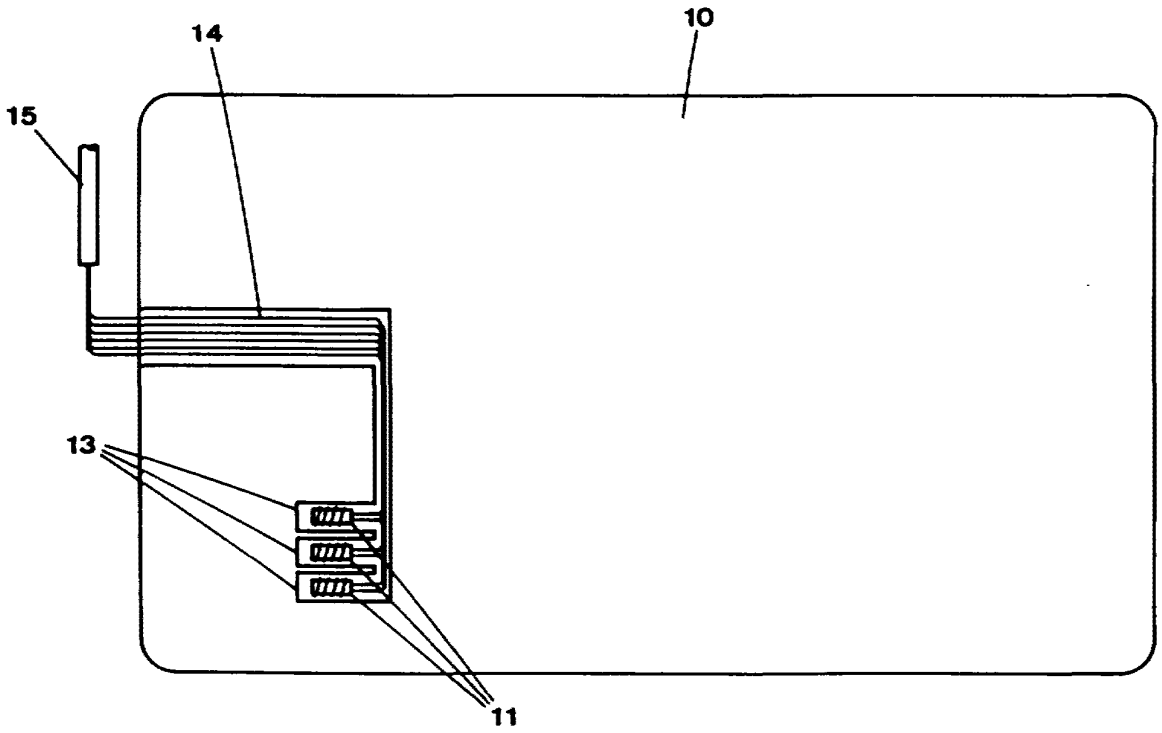


Figure 3

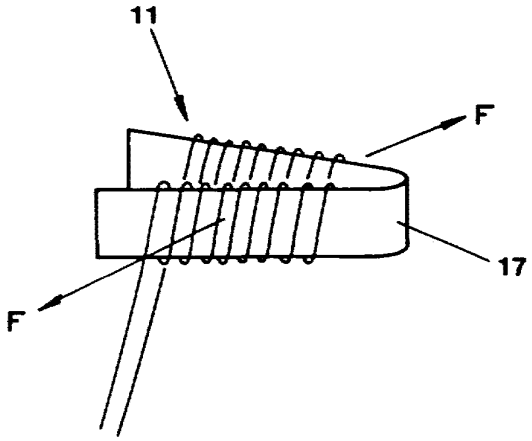


Figure 4

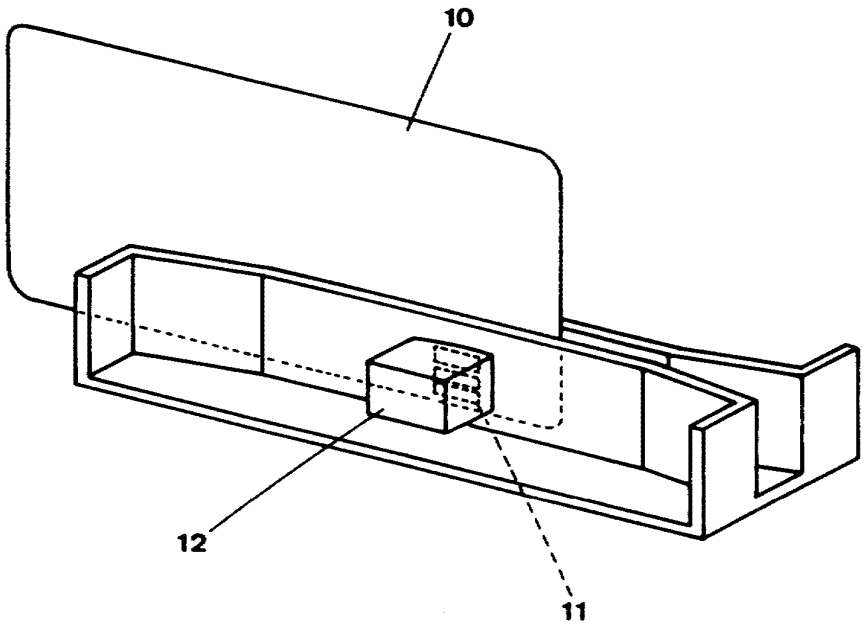


Figure 5

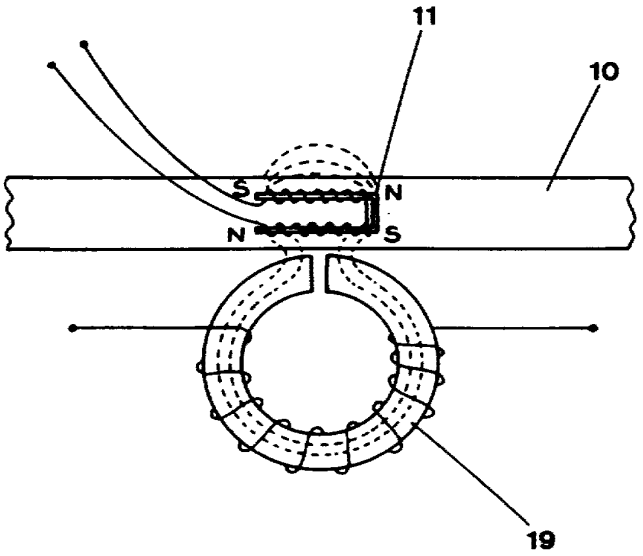


Figure 6

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/NZ 96/00002

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: G06K 19/06, 7/08

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[6] : AS ABOVE AND G06K 19/067, 19/07, 19/073, 19/077

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DERWENT : MAGNETIC SIMULAT EMULAT APPEAR SEEM
JAPIO : MAGNETIC SIMULAT EMULAT APPEAR SEEM

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4786791 (HODAMA) 22 November 1988 column 1 lines 28-35, 65-68, column 2 lines 8-10 figures 3, 4, 5 column 6 lines 1-13	1, 12, 13 2 5, 6, 7
X	US 4791283 (BURKHARDT) 13 December 1988 column 3 lines 5-48 figures 4, 5 figure 7	1, 12, 13 2 3

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

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Date of the actual completion of the international search	Date of mailing of the international search report
4 April 1996	23RD APRIL 1996.

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INTERNATIONAL SEARCH REPORT

International Application No.
1 /NZ 96/00002

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 701601 (FRANCINI et al) 20 October 1987 column 3 lines 23-50, column 5 lines 12-25 column 4 lines 42-49, column 5 lines 32-42 column 4 lines 64-68	1, 12, 13 5, 6, 7 2
A	EP 0554830 A1 (ANGEWANDTE DIGITAL ELEKTRONIK) 11 August 1993 whole document	1-17
A	US 4818853 (OHTA et al) 4 April 1989 whole document	1-17

INTERNATIONAL SEARCH REPORT

Information on patent fami members

International Application No.
PCT/NZ 96/00002

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	4786791	AU	14235/88	WO	8806324		
US	4701601	AU EP	56547/86 203683	CA JP	1252890 6098866	DE	3687186
US	4818853	DE	3771588	EP	249356	JP	62275790

END OF ANNEX

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(74) Agent: WHITE, Martin, David; Marks & Clerk, 57-60 Lincoln's Inn Fields, London WC2A 3LS (GB).

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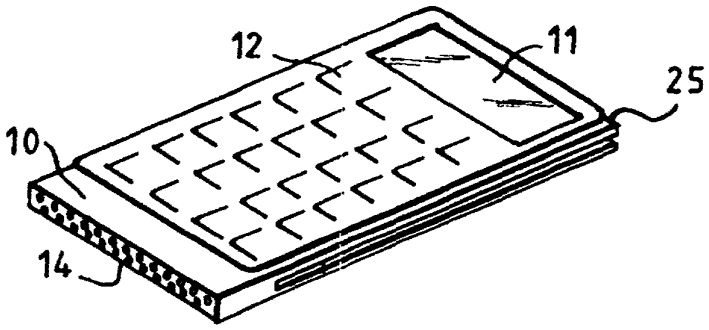
Published

Without international search report and to be republished upon receipt of that report.

(54) Title: POCKET VALUE TERMINAL

(57) Abstract

A pocket value terminal comprises a pocketable case (10), a display (11) and a keyboard (12). The case is designed to receive and electrically connect with contact chip cards to carry out various transactions. The case has a multi-pin connector (14) enabling the terminal to be connected to external devices. The central microprocessor may be mounted on a plastic board that also caries a contactless chip. Alternatively, the contactless chip may be mounted on a separate board and held and supported in convenient proximity with the terminal. In this way the terminal acts as a value transfer and communicating device, and can also be used, in contactless mode, to purchase rail journeys and the like.



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POCKET VALUE TERMINAL

The invention relates to a pocket value terminal that is associated with electronic transaction cards that incorporate a memory, frequently known as smart cards or chip cards, and associated hand-held devices.

The cards consist of a thin rectangular section (typically 85.6 mm x 53.98 mm x 0.76 mm) of plastic material into which is imbedded an integrated circuit which contains complex memory and logic circuits, that operate according to various ISO standards and enable the user to conduct a commercial transaction with a service provider. Such integrated circuits are referred hereinafter as "chips".

Various technologies are used for bi-directional communication with the Smart card chips, two of these methods are known as "contact" and "contactless".

Contact chip cards are supplied with contact pads on the surface of the card that are bonded to the chip. It is via a physical electrical connection to these contact pads that communication is accomplished. In contrast, communication to the contactless card chip is achieved

remotely via a radio frequency signal transmitted from an external reader, typically over a distance of around 6 to 10 centimetres. Signals are received via a tuned thin wire aerial in the form of a multi layer loop imbedded in the periphery of the chip card and connected to the chip.

The invention can be applied to any number of chip cards utilising the aforementioned technologies and other associated hand-held devices. Such cards can encompass many applications, typical applications would include, financial transaction cards, stored value cards for transport, telecommunications, car parking meters, identity cards and the like. Such cards are individually prepared and used and, generally stated, comprise a separate card for each function.

A multiple chip requirement could be achieved by developing a combination chip that combines various individual chip function characteristics into a single microprocessor chip. Such a combination leads to extra difficulty with respect to the management protocols of the various functions and in some cases would add greatly to the costs. In terms of mass production or otherwise, it

also involves considerable design expense because for each form of combination a specially designed chip is required.

Additionally because of the unproven acceptance level of the individual technologies, many service providers are unwilling to risk the success of their technology by combining with another unproven technology. This is particularly evident in the current integration efforts within the Transport and Financial sectors.

Industry observers expect that the migration for service providers from using separate chip cards to a possible final single combination chip card solution would require development through several stages.

Typically these stages would be:

Individual cards containing one dedicated chip, to a single card containing two separate chips, to finally a single combination chip combining the features of both technologies.

The invention addresses the need for a mechanism to enable service providers to integrate their technologies during the development phases from independent cards to a

possible combination card.

By providing a common interface that is both independent of the technologies and secure for each of the service providers, the long term financial, legal, operational and techological concerns related to the integration of their services can be addressed.

Typical commercial issues with respect to, ownership of the card, what powers does the owner have over the data stored on any single application, and who is responsible for establishing the data structures and security mechanisms need evaluation, these and the economic benefits from shared ownership can be carefully considered before committing to the combination chip architecture.

There exists today various hand-held devices in everyday use, these may take the form of a pager, mobile telephone, calculator, electronic wallet, organiser, card value reader, or the like. These devices typically incorporate features such as, a display, input interface, printed circuit board and a processor. The cards relating to this invention, and the associated

hand-held devices can be regarded as having their respective communication, memory and processing features concentrated in electronic modules mounted on either plastic cards, or printed circuit boards.

In any event and broadly stated, each of the chip cards relating to this invention can be regarded as a simply suitable encapsulation of a chip and other components as applicable. The encapsulation ensures the integrity of the chip, and its components, and allows such chip cards to be manually handled and, where appropriate, electrically "plugged in" to a device or appliance or simply placed in a slot, e.g. for a financial transaction device inserted in a cash dispenser slot.

Some chip cards are remotely sensed, interrogated and monitored using so-called "contactless technology". Already contactless chip cards are used for railway station entries, road toll collections and electronic driving licenses, for example, where the card is simply "shown" at a distance by a holder or mounted on a vehicle, and automatically communicates with a

stationery reader or monitor.

The invention also has application with pagers, mobile phones, calculators, electronic wallets, organisers, card value readers and the like and may be applied to a circuit board that carries one or more chips, and some other electrical components where applicable. For the purposes defining embodiments of the invention, any of the chip cards and associated hand-held devices where applicable, will be referred to as "pocketable communicating devices" to give an indication to their size, format and function.

According to the invention there is provided a combination of two or more different discrete pocketable communicating devices each having a respective microprocessor chip for performing its discrete functions, in which the devices are arranged to be physically associated with one another, and one of the devices is a contactless chip card.

Each device may have a separate chip and a single holder or wallet provided to carry the chips physically close

to one another in association with one another.

Each device may comprise a separate supporting card of plastic material and a housing arranged to receive and carry the two or more cards physically close to one another.

In some of the devices the contactless chip card may be formed or carried on the same plastic card as the other or one of the other devices.

An aerial for the contactless device may be formed by conductors printed on the, or one of the plastic cards of the other devices.

One of the devices may comprise a manually operable pocket value terminal incorporating an independent microcomputer. One of the functions of the microcomputer is to communicate directly to one or more pocketable communicating devices, or to enable communications between two or more of these devices, when the devices are physically placed close to the microcomputer during the communicating.

The pocket value terminal may be arranged to contain a mechanism for receiving and holding at least two chip cards in position. The pocket value terminal preferably includes a facility to communicate to and/or between at least a chip card and the microcomputer, in which case the contact chip card is electrically connected during the communication process by exposed contacts to the pocket value terminal.

The pocket value terminal preferably also has a multi-pin connection connectable to other appliances.

The housing may comprise a wallet arranged to contain the pocket value terminal.

In the combination, one of the devices preferably comprises a commonly used electrical device that fits into a person's pocket.

One of the devices preferably contains a central processor card. The central processor card may be provided with the means for communicating directly to a chip in another card physically placed adjacent the

central microprocessor card during the communicating.

A device may be arranged to contain the central processor and have a mechanisms for receiving and holding other cards with similar chips in position.

A chip card value reader may be provided and arranged to display the value residing in the memory of a chip card when physically placed within the device.

A holder or a wallet may be arranged to control and transfer value between various other cards physically placed adjacent the central processor, or into a common access area within the central processor.

Embodiments of the invention will now be described by way of example with reference to the accompanying schematic drawings in which:-

Figure 1 is an isometric top view of a pocket value terminal;

Figure 2 shows an isometric top view of a printed

circuit board for the device and forming a combined central processor and contactless chip;

Figure 3 shows an isometric bottom view of the printed circuit board for the device;

Figure 4 shows an isometric bottom view of the terminal;

Figure 5 shows an isometric bottom view of an ISO 7816 type contact chip card;

Figure 6 shows an isometric top view of a Mini or SIM type contact chip card;

Figure 7 is a clip-on battery pack for the terminal;

Figures 8a and 8b is the pocket value terminal connected to a Cellular Telephone handset;

Figure 9 is the pocket value terminal connected to a PSTN telephone and modem; and

Figure 10 is the pocket value terminal connected to a personal computer.

Referring to the drawings, the terminal is provided in a laminar shaped pocketable case 10, having an area approximately equal to a normal credit card, and provided with a liquid crystal display 11 and a keypad 12. A multiple pin connector 14, mounted at one end of the case 10 enables the terminal to be electrically connected to a flat battery pack 15 which is mounted in a container 16 that forms a convenient support or mounting for the case 10. Another multiple pin connector 25 is mounted at the other end of the case 10. The case 10 can also connect to various appliances such as a mobile phone, or personal computer. In the latter case, the case 10 will connect into a compatible computer slot, preferably the 68 pin PCMCIA slot or the RS232 slot of the personal computer in a normal way. (See Figure 10.)

In Figure 3, a printed circuit board 17 is mounted with a type ISO 7816 contact chip connector 13 and a second

Mini or SIM type contact chip connector 18 into which can be inserted a Mini or SIM contact chip card 19.

A microcomputer 24 of the terminal mounted on the printed circuit board 17 enables direct communication with contact chip cards 19 and 22 inserted into the contact chip connectors 18 and 13. In use the chip cards 19 and 22 are programmed to communicate in a totally secure manner with the terminal according to a known Mondex (trade mark) system, or other similar chip card systems.

In accordance with the embodiments of the invention, a contactless chip circuit is provided and comprises a separate contactless chip 20 and an aerial 21 mounted and formed on the printed circuit board 17 respectively. The chip 20 is totally separated from and independent of the microcomputer 24 and the aerial 21 is also electrically isolated from the microcomputer 24. Indeed, as a matter of convenience to maintain overall versatility, the contactless chip card is preferably formed in a separate manufacturing or assembly operation, before the microcomputer 24 and its

components have been added to the plastic board. Encapsulation with resin, for example, may however take place after both the microcomputer 24 and the contactless chip 20 have been mounted to the same printed circuit board.

In figure 5, a second contact chip card 22 is shown. The contact chip card 22 fits in position, opposite the contact chip connector 13, when the card 22 is inserted in between the rear of case 10 and the battery pack 15. According to the Mondex system, the second card 22 may belong to another person, and the arrangement enables, via a separate communication link between the contact chip cards 19 and 22, and microcomputer 24, transfer of cash values between the cards in accordance with the instructions manually initiated by the keyboard 12 of the terminal. In this way, cash can be transferred, typically cash for goods and services, between two persons. As mentioned earlier, these arrangements allowing secure transfer of cash values between two chip cards are already known as such.

In terms of embodiments of the invention, the described arrangement represents a typical example, where the contactless chip card is used for example for purchasing rail journeys or ticketless flight reservations. The user of the described device can carry out transactions using a contact chip card, such as obtaining cash at a cash dispenser or transferring money to another like card holder, these value or data transfers can also be effected by connecting the pocket value terminal to a Cellular Mobile Phone, as shown in Figs 8a and 8b, enabling the transfer between the contact card inserted in the pocket value terminal and the financial institution to be completed remotely over the digital cellular network.

A typical cellular system would be the Global System for Mobile communications (GSM) utilising the Short Message Service and Over The Air data transfers possible under Phase 2+ of the GSM Standard.

The user can also obtain information via the terminal's display, relating to the remaining value stored on the contact chip card or the most recent transactional data.

In addition, in a contactless mode, a holder may also obtain information relating to the remaining value stored on the contactless chip card or the most recent transactional data or may enter and leave a railway station, or board an aircraft without the need for a conventional airticket . The contactless chip feature may also be devised and used as an identity card for entry to a "secure" office, for example.

Additionally, the user, when conducting transactions with either the contact card or the contactless card features of the terminal, can accumulate loyalty points that have a predetermined relationship to the value of his purchases with either the contact card, or the contactless features of the terminal.

These points can be converted by the relevant service provider into a value format that can be stored in a public partition of the microprocessor 24, that is accessible by both the contact card service provider and the contactless card service provider, and used jointly or severally by the service providers for distribution

between themselves and/or with the users.

The contactless device in the described embodiment is formed on the same plastic board that support the terminals' electronic components. In other applications the contactless device may be formed on a same printed circuit board that supports pager, mobile telephone, calculator, card value reader, electronic wallet or organiser, electronic components. On the other hand, the contactless device may be quite separate, as well as being also discrete in the manner above, and so simply placed or used in proximity with the chip boards of the other "communicating" devices, which devices include the terminal (as described) that communicates with chip cards such as 19 and 22

In any event it will be appreciated that in embodiments of the invention the contactless function is a kind of "add-on" to a communicating device, such as a pocket value terminal, say. There are at least three advantages with providing such an arrangement. Firstly, there is no need to re-design and technically prove the contact chip or the contactless chip as they are known

and generally available per se. Secondly, several different kinds of contactless chip cards can be selected and added to one of a variety of contact chip cards. Thirdly, because there are no battery requirements for contactless operation, or generally, the contactless function can be provided next to a standard printed circuit of a pager, a mobile telephone, a calculator, a card value reader, an electronic wallet, an electronic organiser or other devices. As such, the pager and so forth can be used for its normal function and also used to obtain entry to a railway station using the incorporated or added-on contactless chip card feature.

A further advantage of maintaining the chip functions separate is that it maintains privacy and security between the respective service providers and/or users.

It will be noted that the user or holder of the described device may be informed, using the microcomputer 24, of the status of the value remaining on his chip card and has means of privately obtaining the most recent transactional data relating to his

cards. At present means for accessing this information are generally located at the service provider, and in many cases such information is not easily available.

Instructions relating to all the foregoing can be carried out by the combined use of the display and key input features of the pocket value terminal.

Other variations based on the pocket value terminal can be provided to enhance its overall usefulness. The pocket value terminal may be connected to an information system for the transfer of data and/or value via either of two multipin connectors provided on the terminal. In one arrangement the pocket value terminal may be connected to an information system via the 68 pin PCMCIA connector 14. The information system could be accessed by an appliance such as a personal computer, personal digital assistant, or any other device that contains a connecting slot that is compatible with the terminal's 68 pin PCMCIA connector and associated unique connector alignment profile.

Alternatively the information system may be accessed by means of a telephone network. To achieve this the

terminal is connected to the telephone network via a telephone handset, which may be a mobile phone or a special handset designed for the purpose. The most recent of mobile digital telephones are equipped with data transfer connection slots, to which the pocket value terminal is connected in use by the second multi-pin connector 25 located on the periphery of the terminal, as shown in Fig 8a, the data transfers are enabled by integrating proprietry software drivers provided by the cellular handset manufacturers into the pocket value terminal that are compatible with the communication protocols of the cellular handset.

Alternatively the pocket value terminal can be connected via the 68 pin PCMCIA connector 14 to mobile digital telephones that are appearing with PCMCIA compatible slots located at the base or side of the cellular handset as shown in fig 8b.

A similar configuration is possible with a telephone handset connected to the Public Switched Telephone Network (PSTN) incorporating a modem designed for data transfers, as exhibited in Fig 9.

In any of these data transfer arrangements the pocket value terminal contributes a significant increase in computing capacity not available to chip cards in their independent state. This increased computing power enables the pocket value terminal to act as an "intelligent" partner to a relatively simple chip card, by performing the functional workload such as implementation of security measures, typically full asymmetric cryptography which demand large computing facilities.

A further consideration is the need for the pocket value terminal to have a sufficiently large electrical power source. This is achieved with a large capacity plug-in power pack which may be rechargeable, and is of a format that does not contribute significantly to the terminal's weight or bulk as shown in Figure 7, connection to the pocket value terminal may be via the 68 pin connector 14.

Additionally, the pocket value terminal, maintains in such a data transfer configuration, the feature available in previous embodiments, of being able to

accommodate several chip cards simultaneously, and to be able to communicate to or between the inserted chip cards and the information systems. This can result in the transfer of value via the communication system, typically between a chip card and a financial institution. The remaining value residing on the chip card can be read from the terminal's display, prior to the removal of the card from the pocket value terminal, and the card then used in a normal transactional manner.

In a further embodiment the pocket value terminal is used

in a communication system connectable to an interactive market, or similar virtual network. This may be via the previously described transmission systems or by mass market devices, specially designed for this interactive medium. Such devices include TV set-top boxes and Internet connecting devices. By connecting the pocket value terminal to these devices, small value payments can be transferred instantaneously from the inserted chip card for services such as pay to view movies, or specially televised sporting events. It is also possible to use the pocket value terminal for payments over the

Internet for a multitude of goods and services that are and will be available from this medium. Typically the majority of payments via these networks are 'micro-payments', being of small value and not economically transacted by conventional credit card means due to the relative high cost of the associated transaction accountability.

Instructions relating to all the foregoing connections with the communicating systems can be carried out by the combined use of the display and key input features of the pocket value terminal or the computer terminal, telephone or other connected device.

Computers and digital technology have opened new markets that require secure and swift remote payment arrangements.

Remote payments need high-levels of security to guarantee protection against counterfeit and fraud, against criminals or computer hackers, who would seek to intercept or divert value transfers between legitimate parties. It is obvious that with the potential for

exponential growth of remote payments via virtual networks, the requirement for improved security is essential.

In some or most embodiments it is necessary to have a security facility. This is generally an underlying requirement for most users of cash transactions. Advanced card systems use cryptographic safeguards in conjunction with personal identification of the user. Personal identification systems are generally based on three parameters associated with, something someone knows such as a personal identification number (PIN), something that someone has, such as a badge or card, or some biocharacteristic of the individual, such as a fingerprint or speech pattern.

In an embodiment of the invention the pocket value terminal with the plug-in battery pack shown in Figure 7 attached, is provided with a biometric template of the card user based on his fingerprint, voice or other such data. This template is used to compare real time input of corresponding biometric data from the user, prior to the use of the card. A positive result of this biometric

comparison creates a time based link to the activation of the value segments of the inserted chip card. After removal of the plug-in power pack from the 68 pin connector, the pocket value terminal can be inserted into a compatible connecting slot in a personal computer to complete the value transfer within the designated period.

Alternatively the pocket value terminal with the plug-in powerpack attached can be connected to a compatible telephone via the multipin connector 25. The biometric authentication can be carried out whilst connected to the telephone network or independently and then connected to the telephone network, as previously explained.

In all cases transfers are not possible unless both the user has been accepted by the biometric authentication process, and the user's chip card is inserted into the pocket value terminal while the pocket value terminal is connected to the PC computer or compatible telephone. Removal of the chip card from the pocket value terminal will terminate the connection.

The action of the biometric authentication together with the unique identifier relating to the integrated circuit of the inserted chip card may also be used to produce a session key for the transaction period selected by the user during the authentication process. This session key further enhances the security that presently exists in some chip card transaction protocols. For each new log-on to the communication system a new session number is generated, and only for the period decided by the user.

Additionally the memory may be expanded for more involved biometrics by storing the biometric template on any of the emerging mini format flash memory card that can be an additional plug-in device to the pocket value terminal.

It will be appreciated that whereas a certain contactless device has been described with a chip mounted on a board and an aerial formed, by printed circuit or other technique, on the board, other contactless arrangements may be used. Such other

contactless arrangements included cards that are read during proximate inductive coupling where the card is normally presented quite closely up to or near a reader. In all cases, the contactless device is any device that does not actually electrically contact the reader directly and is a separate or separately operable device, as explained in the specification.

CLAIMS

1. A combination of two or more pocketable different discrete communicating devices and each having a respective microprocessor chip for performing its discrete function, in which the devices are arranged to be physically associated with one another, and one of the devices is a contactless device.

2. A combination according to claim 1, in which each of the devices has a separate chip and a single holder or wallet is provided to carry the chips physically close to one another in association with one another.

3. A combination according to claim 1, in which each of the devices is formed on or carried by a respective single printed circuit board.

4. A combination according to any of claims 1 to 3, in which an aerial for the contactless device is formed by conductors printed on the or one of the printed circuit boards.

5. A combination according to any of claims 1 to 4, in

which one of the devices comprises a commonly used electrical device that fits into a person's pocket.

6. A combination according to any of claims 1 to 5, in which one of the devices contains a central microprocessor card.

7. A combination according to any of claims 1 to 6, in which the central microprocessor card is provided with the means for communicating directly to a chip in another card physically placed adjacent the central microprocessor card during the communicating.

8. A combination according to any of claims 1 to 7, including a device arranged to contain the central microprocessor, the device having mechanisms for receiving and holding other cards with similar chips in position.

9. A combination according to any of claims 1 to 8, including a device arranged to contain a clip-on re-chargeable battery pack, to supply electrical power.

10. A combination according to claim 9, including a chip card value reader arranged to display the value residing in the memory of the chip of a card physically placed within the device.

11. A combination according to claim 9, including a wallet arranged to transfer loyalty value between various other cards physically placed adjacent the central microprocessor.

12. A combination according to claim 9, including a connector that enables connectivity to cellular mobile phones to facilitate the transfer of data or value via the cellular network between financial institutions or other card holders to cards physically placed adjacent the central processor.

13. A combination according to claim 9, including a connector that enables connectivity to personal computers to facilitate the transfer of data or value via the personal computer communication network between financial institutions or other card holders to cards physically placed adjacent the central processor.

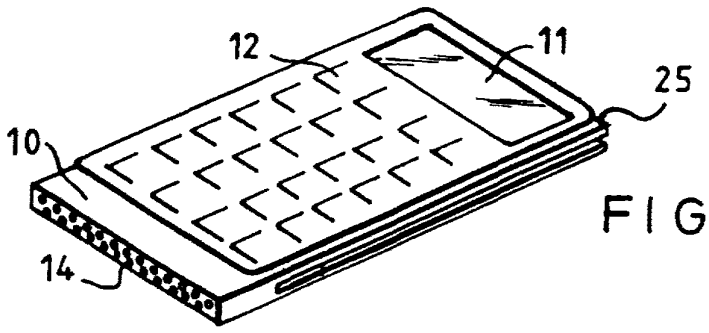


FIG. 1

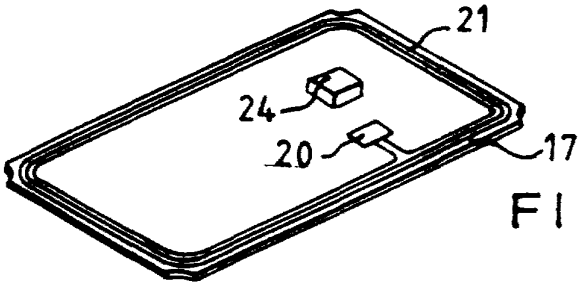


FIG. 2

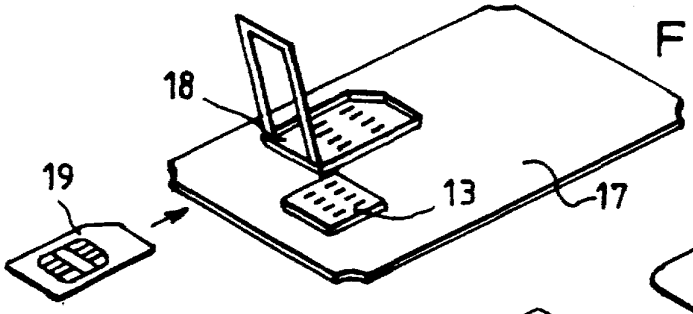


FIG. 3

FIG. 6

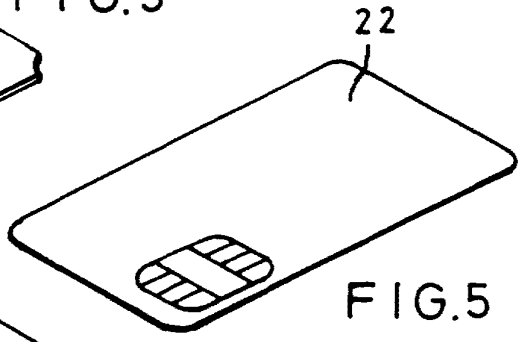


FIG. 5

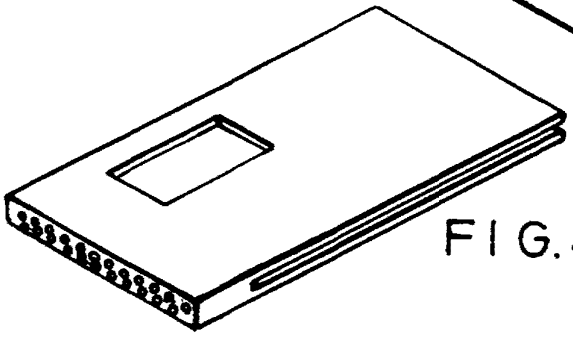


FIG. 4

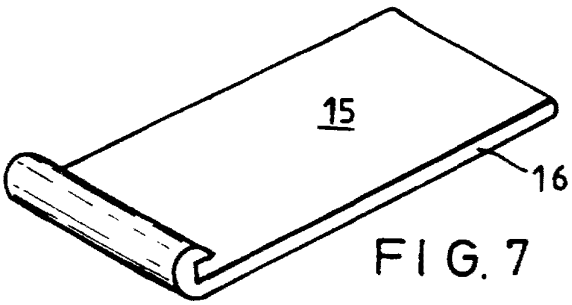


FIG. 7

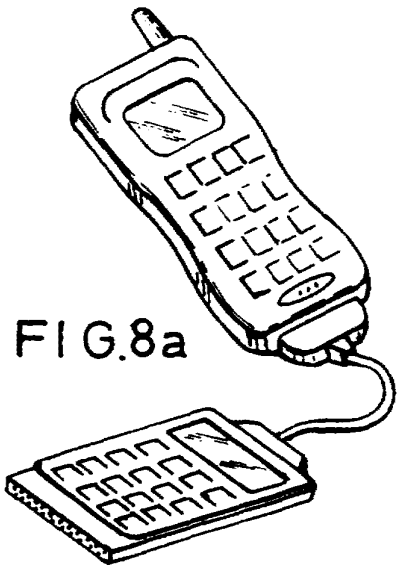


FIG.8a

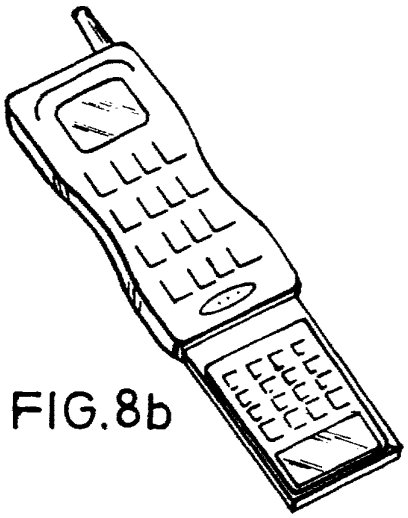


FIG.8b

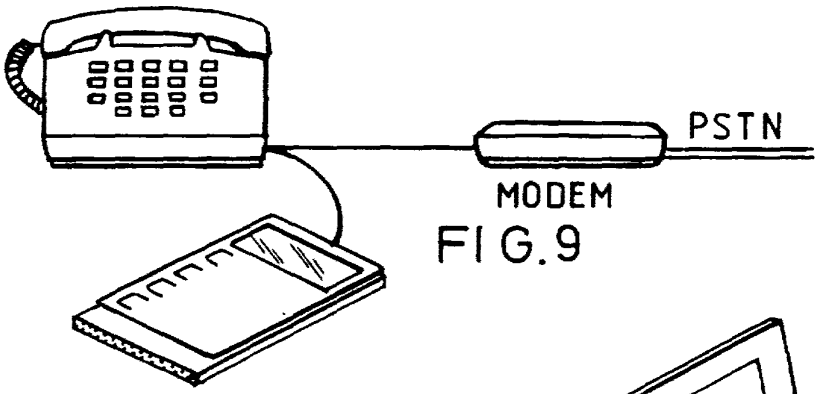


FIG.9

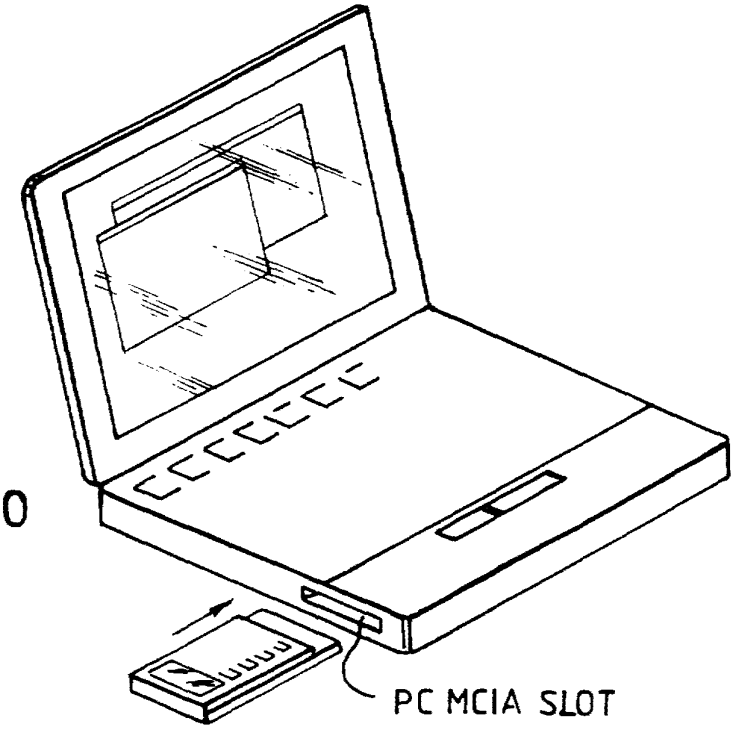


FIG.10

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Filer:	Dana B. LeMoine/Theresa LeMoine
Attorney Docket Number:	115.001US9.4

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	280	280
Utility Search Fee	1111	1	600	600
Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1600**

Electronic Acknowledgement Receipt

EFS ID:	23284658
Application Number:	14833113
International Application Number:	
Confirmation Number:	5303
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Customer Number:	35781
Filer:	Dana B. LeMoine/Theresa LeMoine
Filer Authorized By:	Dana B. LeMoine
Attorney Docket Number:	115.001US9.4
Receipt Date:	23-AUG-2015
Filing Date:	
Time Stamp:	15:05:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1600
RAM confirmation Number	7637
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	115_001US9_4_aia0014_8-22-2015.pdf	1789965 7a8fe7c7e043c88bf569180cc516cd138cfe2526	no	8
Warnings:					
Information:					
2		115_001us9_4.pdf	144565 6e5e127cb307f479b6bbff5264dce08eda9510a6	yes	33

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Specification	1	29
	Claims	30	32
	Abstract	33	33

Warnings:					
Information:					
3	Drawings-only black and white line drawings	115_001us9_4_dwgs.pdf	800387 d9428d23f11cba9076409bc3b17214cdc0656d5d	no	16
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5	Information Disclosure Statement (IDS) Form (SB08)	115001US94_IDS_8-23-2015.pdf	1014078 30124fc1a3db9d64a16c71d1acd0ffa922fa2665	no	34
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16	Foreign Reference	JP2000010668A.pdf	370491 79b6268755b9f627092a5b9f3fe0c81abd6aefc9	no	8
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17	Foreign Reference	JP2005018671A.pdf	373304 e6fa4f42cf25d619635c245dd806c5393527c259	no	11
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19	Foreign Reference	JP2007328689A.pdf	339431 0a2cdd29f568f74fe516daeb2f565120b44a1b56	no	10
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20	Foreign Reference	JP04102112A.pdf	35806 31639066f6e47f2e3e14f8692ac7ba9b39a47a59	no	3
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21	Foreign Reference	TW200905471.pdf	1279477 ea03b4a0a5a9091a82c2f34d6f9087f1657bdf74	no	39
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22	Foreign Reference	TW201020934.pdf	1730754 233f13d9001213a545aa3952e1833d873a56de98	no	53
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23	Foreign Reference	TW201023662.pdf	1749731 c87e194b663206dcb0ce85943690af3e9a686964	no	52
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24	Foreign Reference	TW201126422.pdf	1071266 38940acbc069a132597187e7151054c19c505824	no	33

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25	Foreign Reference	TW2001I336449B.pdf	184566 afe0786cda44b296ad14803cf86f5c5261e92522	no	6
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Information:					
		Total Files Size (in bytes):	52813406		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Siva	G.	Narendra	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Portland	State/Province	OR	Country of Residence i	US

Mailing Address of Inventor:

Address 1	7180 SW 84th Ave.		
Address 2			
City	Portland	State/Province	OR
Postal Code	97223	Country i	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Thomas	N.	Spitzer	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Portland	State/Province	OR	Country of Residence i	US

Mailing Address of Inventor:

Address 1	2642 SW Bucharest Ct.		
Address 2			
City	Portland	State/Province	OR
Postal Code	97225	Country i	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Prabhakar		Tadepalli	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

City	Bangalore	Country of Residence [i]	IN

Mailing Address of Inventor:

Address 1	E24 Chaithanya Smaran		
Address 2	Whitefield Hoskote Road		
City	Bangalore	**State/Province**	Ka
Postal Code	560067	**Country** [i]	IN

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	35781		
Email Address	Dana LeMoine <dana.lemoine@tyfone.com>	Add Email	Remove Email

Application Information:

Title of the Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS		
Attorney Docket Number	115.001US9.4	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	16	**Suggested Figure for Publication (if any)**	20

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country [i]

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	35781		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the application number blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	14747770	2015-06-23

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14747770	Continuation of	14680684	2015-04-07	9092708	2015-07-28

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14680684	Continuation of	13592323	2012-08-22	9004361	2015-04-14

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13592323	Continuation of	13304663	2011-11-27	8573494	2013-11-05

Prior Application Status	Patented	Remove

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13304663	Continuation of	13114434	2011-05-24	8091786	2012-01-10
Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
13114434	Continuation of	12941410	2010-11-08	7954715	2011-06-07
Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12941410	Continuation of	12539369	2009-08-11	7828214	2010-11-09
Prior Application Status	Patented			Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12539369	Continuation of	11063291	2005-02-22	7581678	2009-09-01

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) [i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country [i]	Filing Date (YYYY-MM-DD)	Access Code [i] (if applicable)

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date o f filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

(•) Assignee	( ) Legal Representative under 35 U.S.C. 117	( ) Joint Inventor
( ) Person to whom the inventor is obligated to assign.	( ) Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. [X]

Organization Name	Tyfone, Inc.

Mailing Address Information For Applicant:

Address 1	5331 SW Macadam Avenue		
Address 2	Suite 251		
City	Portland	**State/Province**	OR
Country [i]	US	Postal Code	97239
Phone Number	(503) 226-3939	Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not subsitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication . An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

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If the Assignee or Non-Applicant Assignee is an Organization check here. [ ]

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	115.001US9.4
	Application Number	
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Signature	/Dana B. LeMoine/			Date (YYYY-MM-DD)	2015-08-22
First Name	Dana B.	Last Name	LeMoine	Registration Number	40062

Additional Signature may be generated within this form by selecting the Add button. Add

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent C o o p eration Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

Field

The present invention relates generally to electronic devices, and more specifically to electronic devices that may perform transactions.

Background

Magnetic cards have many purposes. Examples include credit cards, debit cards, stored value cards, identification cards, access entry cards, and the like. Many of these cards have information stored in a magnetic stripe in a static manner. For example, a credit card may have a credit card number, a cardholder's name, and an issuing bank's name statically encoded in a magnetic strip. Likewise, an identification card or access entry card may have statically encoded information that identifies an individual or allows access to a controlled access area. When the card is swiped through a magnetic card reader, the information is transferred to the magnetic card reader to perform a transaction, such as a financial transaction or identification transaction.

Brief Description of the Drawings

Figures 1, 2A, and 2B show intelligent electronic devices and electronic transaction cards;

Figure 3 shows a block diagram of an electronic transaction card;

Figure 4 shows an electronic transaction card in a magnetic card reader;

Figure 5 shows an intelligent electronic device and card in a card reader;

Figures 6-8 show adapters for use with electronic transaction cards;

Figures 9 and 10 show an electronic transaction card having a smartcard interface;

Figure 11 shows an adapter in combination with an electronic transaction card;

Figure 12 shows an adapter having an aperture to receive an electronic transaction card;

Figure 13 shows another adapter embodiment;

Figure 14 shows an electronic transaction card;

Figure 15 shows an electronic transaction card and adapter combination;

Figure 16 shows an example swallow-type card reader;

Figure 17 shows a combination electronic transaction card and adapter being swiped through a magnetic card reader;

Figure 18 shows a financial transaction card;

Figure 19 shows a memory card;

Figure 20 shows a block diagram of a combination memory card and electronic transaction card;

Figure 21 shows a diagram of how a card may be utilized;

Figure 22 shows a block diagram of a combination memory card and electronic transaction card; and

Figure 23 shows a block diagram of a phone and a card.

Description of Embodiments

In the following detailed description, reference is made to the accompanying drawings that show, by way of illustration, various embodiments of an invention. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention. It is to be understood that the various embodiments of the invention, although different, are not necessarily mutually exclusive. For example, a particular feature, structure, or characteristic described in connection with one embodiment may be implemented within other embodiments without departing from the spirit and scope of the invention. In addition, it is to be understood that the location or arrangement of individual elements within each disclosed embodiment may be modified without departing from the spirit and scope of the invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the

appended claims, appropriately interpreted, along with the full range of equivalents to which the claims are entitled. In the drawings, like numerals refer to the same or similar functionality throughout the several views.

Figure 1 shows an intelligent electronic device and an electronic transaction card. Intelligent electronic device 102 is shown as a mobile phone in Figure 1, but this is not a limitation of the present invention. For example, intelligent electronic device 102 may be a personal digital assistant (PDA), a smartphone, a mobile phone, a handheld computer, or any other device capable of operating as described herein.

Intelligent electronic device 102 includes add-on slot 110. Add-on slot 110 is a slot capable of accepting electronic transaction card 104. For example, add-on slot 110 may have physical dimensions compatible with electronic transaction card 104, and may have a communications interface that operates using a protocol compatible with electronic transaction card 104. In some embodiments, electronic transaction card 104 includes an identification number that provides a relationship to intelligent electronic device 102. For example, electronic transaction card 104 may include an ID number that provides a unique pairing relationship or a non-unique pairing relationship between electronic transaction card 104 and intelligent electronic device 102.

In some embodiments of the present invention, add-on slot 110 is a memory card slot designed to accept and communicate with memory cards. As used herein, the term "memory card slot" refers to any add-on slot capable of accepting a card having memory accessible by an intelligent electronic device such as that shown in Figure 1. For example, a memory card slot may be a proprietary card slot designed to accept memory cards that adhere to a proprietary communications protocol. Also for example, a memory card slot may be compatible with an industry standard communications protocol, or may be compatible with a widely accepted communications protocol that is not necessarily formally documented as an industry standard. Examples include slots that are compatible with the Multimedia Memory Card (MMC) protocol, Memory Stick DUO protocol, secure digital (SD) protocol,

and Smart Media protocol. The foregoing list is meant to be exemplary, and not exhaustive. Add-on slot 110 may be compatible with many memory card slot protocols other than those explicitly listed above without departing from the scope of the invention.

Electronic transaction card 104 includes electrical contacts 108 and stripe 106. Electrical contacts 108 are contacts that provide a communications interface to communicate with add-on slot 110. For example, electrical contacts 108 may provide connectivity compliant with a communications protocol for memory cards.

Stripe 106 represents an area on an external face of electronic transaction card 104 at which one ore more time-varying magnetic fields emanate. For example, one or more time-varying magnetic fields may emanate from the location of stripe 106 to communicate with a magnetic card reader. In some embodiments, the time-varying magnetic field may emulate the time-varying magnetic field produced when a typical magnetic card is swiped through a magnetic card reader. For example, a time-varying magnetic field produced at stripe 106 may emulate the swipe of a credit card, a debit card, or any other card having a magnetic stripe compatible with a magnetic card reader.

In some embodiments of the present invention, stripe 106 may be a visible stripe on electronic transaction card 104. When stripe 106 is visible, it may be used to indicate the location at which the time-varying magnetic field will emanate. In other embodiments of the present invention, stripe 106 may not be visible. For example, circuitry may be included within electronic transaction card 106 to produce the time-varying magnetic field and no visible indication may be present on an external face of electronic transaction card 104.

As used herein, the term "stripe" generally refers to a location on an electronic transaction card, whether a visible stripe exists or not. In this description, the term "stripe" may also be used to refer to a visible marking on a face of an electronic transaction card. Further, a "stripe" may include the functionality provided by one or more time-varying magnetic fields that emanate from the card.

For example, the term "stripe" may refer to multiple magnetic tracks, or multiple "stripes," or emulation thereof.

Stripes, as described herein, may be compatible with one or more standards. A stripe may be compatible with a standard by being in compliance with the standard or by being partially in compliance with the standard. For example, stripe 106 may be compatible with an American National Standards Institute (ANSI) magnetic stripe standard, or an International Organization for Standardization (ISO) magnetic stripe standard. In addition, in some embodiments, a stripe may emulate more than one magnetic track, and the emulated tracks may or may not be offset from the location specified in a standard. For example, one or more wires may be utilized to generate time-varying magnetic fields compatible with a standard, and the wires may be located at or near stripe 106 in a location different than the magnetic track offset described in an associated standard.

As used herein, the term "transaction" refers to any beneficial use of an electronic transaction card. For example, any time stripe 106 emits a time-varying magnetic field to be read by a magnetic card reader or a hybrid smartcard reader, a transaction may take place. Transactions may include financial transactions, access control transactions, or any other type of transaction involving any of the electronic transaction card embodiments described herein. Further, as described in more detail below, in some embodiments of the present invention, transactions may utilize smartcard interfaces on electronic transaction cards in addition to, or in lieu of, stripes that emit time-varying magnetic fields.

In operation, intelligent electronic device 102 may program electronic transaction card 104 for use in a transaction involving stripe 106. For example, intelligent electronic device 102 may program electronic transaction card 104 to operate as a credit card, a debit card, or the like. Electronic transaction card 104 may then be used with a magnetic stripe or smartcard based merchant point-of-sale terminal to effect a transaction. Also for example, intelligent electronic device 102 may program electronic transaction card 104 to operate in any other environment where stripe 106 may be beneficially utilized with a magnetic card reader.

Figure 2A shows intelligent electronic device 202 and electronic transaction card 220. Intelligent electronic device 202 includes add-on slot 210 to receive electronic transaction card 220. Intelligent electronic device 202 is shown having add-on slot on one side, but this is not a limitation of the present invention. For example, add-on slot 210 may be located on top, bottom, or any other surface of intelligent electronic device 202. Also for example, an add-on slot may be created by a clamshell design when the shell is closed. In these embodiments, each side of the clamshell may incorporate a portion of the add-on slot such that the add-on slot is "open" when the clamshell is open.

Electronic transaction card 220 may have any form factor compliant with add-on slot 210. Electronic transaction card 220 is shown having a form factor with an aspect ratio different from that of electronic transaction card 104 (Figure 1). Electronic transaction card 220 includes stripe 222 and may have electrical contacts to interface with add-on slot 210. The electrical contacts may be on the back side of electronic transaction card 220, recessed on an edge of electronic transaction card 220, or on the front side of electronic transaction card 220. In some embodiments, electronic transaction card 220 includes a "contactless" interface to add-on slot 210. For example, electronic transaction card 220 may include an interface to add-on slot 210 that communicates using electric or magnetic fields, infrared (IR) light, or any other suitable communications mechanism.

Electronic transaction card 220 may have an area for imprinting. For example, as shown in Figure 2A, electronic transaction card 220 may have space for imprinting a brand (for a bank or otherwise), and a cardholder's name. Further, electronic transaction card 220 may include space for a cardholder's signature. Electronic transaction card 220 may include any other information, coded or unencoded, visible or nonvisible, without departing from the scope of the present invention.

Intelligent electronic device 202 may include a mechanism to allow intelligent electronic device 202 to communicate with a wired or wireless network. For example, intelligent electronic device 202 may include circuitry to communicate

with a cellular phone network. Note that in these embodiments, intelligent electronic device 202 may or may not be a phone. For example, intelligent electronic device 202 may be a cellular telephone with an add-on slot for use with an electronic transaction card. Also for example, intelligent electronic device may be a non-telephonic device that has cellular network connectivity. Examples include personal digital assistants, and handheld devices dedicated to the use of electronic transaction cards. Further, intelligent electronic device 202 may be a non-telephonic device having wired or wireless connectivity to a network other than a cellular network, and in some embodiments, intelligent electronic device 202 may be a device without network connectivity. Examples include, but are not limited to: Blackberry devices available from Research in Motion (RIM), music players such as MP3 players, cameras, and the like.

In operation, intelligent electronic device 202 may program electronic transaction card to perform a transaction. In some embodiments, communications over a network may play a role in the transaction. For example, intelligent electronic device 202 may receive authorization for the transaction over a network. Also for example, intelligent electronic device 202 may program electronic transaction card 220 to perform a transaction, and then report the transaction to an entity using the network.

Electronic transaction card 220 may be utilized in financial transactions. For example, electronic transaction card 220 may be programmed to operate as a credit card or a stored value card. In these embodiments, electronic transaction card 220 may be programmed to emit one or more time-varying magnetic fields to emulate the swiping of a credit card or stored value card. In some of these embodiments, electronic transaction card 220 may use one number repeatedly, or may use a different number for each transaction. For example, electronic transaction card 220 may be programmed to have one number, similar to how a credit card uses the same number repeatedly. Also for example, electronic transaction card 220 may be programmed to use a different number for each transaction. These numbers are referred to herein as "single transaction account numbers" or "STANs."

Single transaction account numbers may be generated by the card issuer or locally by either an intelligent electronic device or an electronic transaction card. Generation of STANs may be accomplished in any of several ways. For example, when an electronic transaction card is issued, the cardholder may receive several pre-assigned single-use transaction numbers. The numbers may also have a pre-specified sequence. In some embodiments, this sequence may be known only to the issuing bank and the cardholder's intelligent electronic device and/or electronic transaction card. A card issuing bank may authorize payments based on the expected sequence of account numbers, and if out-of-sequence account numbers are used, then the issuing bank may consider that transaction as a potentially fraudulent transaction. The issuing bank may also use this feature to track the merchant involved in the potentially fraudulent transaction.

According to another example, a pre-assigned sequence of STANs may be reset to the original starting number on the list depending on user input or other triggers. In addition, the list of numbers may be periodically downloaded via a cellular phone network or other network connectivity.

Figure 2B shows intelligent electronic device 230 and electronic transaction card 240. Intelligent electronic device 230 is an example of a "wearable" device that is capable of communicating with an electronic transaction card. For example, intelligent electronic device 230 is shown having the form factor of a wristwatch. Some embodiments of the present invention may have other wearable form factors. For example, a wearable intelligent electronic device may be worn in such a manner that it contacts human skin, or it may be worn on clothing. Any wearable intelligent electronic device may be employed without departing from the scope of the present invention. Further, intelligent electronic device 230 may have any of the capabilities described herein.

Intelligent electronic device 230 may include an add-on slot to accept electronic transaction card 230. The add-on slot may be any of the add-on slot embodiments described herein. Electronic transaction card 240 may be any

electronic transaction card. For example, electronic transaction card 240 may be any electronic transaction card embodiment described herein.

Figure 3 shows a block diagram of an electronic transaction card. Electronic transaction card 300 is an electronic transaction card capable of communicating with an intelligent electronic device, and capable of communicating with a magnetic card reader. For example, electronic transaction card 300 may be electronic transaction card 104 (Figure 1) or electronic transaction card 220 (Figure 2A).

Electronic transaction card 300 includes electrical contacts 302, intelligent electronic device (IED) interface 304, nonvolatile memory 306, processing device 308, volatile memory 310, magnetic field producing circuits 312, swipe sensor 314, and stripe 320.

Electrical contacts 302 correspond to electrical contacts 108 (Figure 1). IED interface 304 is coupled to electrical contacts 302 to provide a communications interface between electronic transaction card 300 and an intelligent electronic device. For example, IED interface 304 may be an interface compatible with an add-on slot such as add-on slot 110 (Figure 1) or add-on slot 210 (Figure 2A).

Magnetic field producing circuit 312 includes one or more circuits to produce time-varying magnetic fields at or near the location of stripe 320. For example, one or more current carrying conductors may be excited to produce a magnetic field, and the current may be varied in amplitude and reversed in polarity to cause the magnetic field to be time-varying. In some embodiments, the number of magnetic field producing circuits corresponds to the number of tracks being emulated for stripe 320. For example, stripe 320 may emulate two, three, four, or more magnetic tracks on a magnetic card such as a credit card. In these embodiments, electronic transaction card 300 may include two, three, four, or more magnetic field producing circuits 312. Magnetic field producing circuits 312 may also include circuits to allow control of the time-varying magnetic field. For example, magnetic field producing circuits 312 may include voltage drivers, current drivers, registers to hold digital data, sequential circuits to translate the digital data to magnetic fields, and the like.

Swipe sensor 314 senses when electronic transaction card 300 has been swiped in a magnetic card reader, and provides a swipe indication to processing device 308. The swipe sensor may be a mechanical switch, an electronic switch, or any other type of suitable switch. For example, a mechanical switch may get pressed when electronic transaction card 300 is swiped. Also for example, an electrical sensor may include two or more contacts (not shown) that get shorted when swiped past a metal head within a card reader. Further, a Hall effect sensor or light-based sensor may be utilized. The present invention is not limited by the type of swipe sensor utilized. In some embodiments, swipe sensor 314 is omitted.

Processing device 308 represents a processor capable of communicating with the other blocks shown in electronic transaction card 300. For example, processing device 308 may be a microprocessor, a digital signal processor (DSP), a microcontroller, or the like. Further, processing device 308 may be formed from state machines or other sequential logic. In operation, processing device 308 may read instructions from volatile memory 310 and/or nonvolatile memory 306 and perform actions in response thereto. For example, processing device 308 may execute program instructions that influence communications between electronic transaction card 300 and an intelligent electronic device, or between electronic transaction card 300 and a magnetic card reader.

Volatile memory 310 represents memory that may lose its state when power is removed from electronic transaction card 300. For example, volatile memory 310 may be static random access memory (SRAM). Volatile memory 308 may be utilized by processing device 308 when executing programs. For example, a program may be copied into volatile memory 308 prior to execution. Also for example, processing device 308 may use volatile memory 308 to store data during the execution of a program.

Nonvolatile memory 306 represents memory that does not lose its state when power is removed from electronic transaction card 300. Nonvolatile memory 306 may be any suitable type of memory such as Flash memory with floating gate

transistor memory cells. Examples include NOR Flash memory, NAND Flash memory, and multibit/cell Flash memory.

Nonvolatile memory 306 may hold program instructions that are executable by processing device 308. For example, prior to being sold, a manufacturer or distributor may program nonvolatile memory 306 with program information to influence the operation of electronic transaction card 300. Also for example, an intelligent electronic device may provide program information to electronic transaction card 300 through IED interface 304.

Nonvolatile memory 306 may also hold program instructions that are executable by a processing device other than processing device 308. For example, a manufacturer, distributor, reseller, or other participant in the chain of commerce may program nonvolatile memory 306 with program information to be transferred to an intelligent electronic device. Information to be transferred may include device drivers, application software, or the like.

Electronic transaction card 300 may include one or more power sources (not shown). For example, electronic transaction card 300 may include a battery or a capacitor such as a supercapacitor. In some embodiments, a rechargeable battery may be included. The rechargeable battery may accept a charge from an add-on slot in an intelligent electronic device. In some embodiments, a capacitor may accept a charge from an intelligent electronic device. The capacitor may provide power to electronic transaction card 300 for enough time to perform a transaction. Further, the capacitor may be sized to ensure that a transaction may only be performed during a limited time period after removing the electronic transaction card from an add-on slot, thereby ensuring that a stolen card may not be used repeatedly without the cardholder's consent. Also in some embodiments, electronic transaction card 300 may be programmed to go dormant if a transaction is not performed within a limited time period after removing the card from an intelligent electronic device.

Electronic transaction card 300 may include one or more integrated circuits. For example, processing device 308 may be on one integrated circuit die, and the memories may be on another integrated circuit die. In some embodiments, all active

devices are included on a single integrated circuit die. In some embodiments, various integrated circuit dice are mounted on a common substrate to provide a high level of integration using separate dice. Any amount of circuit integration may be practiced without departing from the scope of the present invention.

Electronic transaction card 300 has dimensions "*a*" and "*b*." In some embodiments of the present invention, stripe 320 has a length that is substantially equal to *a*, and in some embodiments, stripe 320 has a length less than *a*. Further, in some embodiments, *a* is less than the stripe length of a standard credit card (approximately three and three eighths inches), and in some embodiments, *a* is much less than the stripe length of a standard credit card. For example, in some embodiments, *a* is less than 75% the length of a standard credit card stripe. Further, in some embodiments, *a* is less than 50% the length of a standard credit card stripe. In still further embodiments, *a* is less than 25% the length of a standard credit card stripe.

In some embodiments, dimensions *a* and *b* are substantially equal to the dimensions of a memory card. For example, dimensions *a* and *b* may conform to the dimensions of an MMC memory card, a Memory Stick PRO DUO memory card, or other memory card. Further, in some embodiments, electronic transaction card 300 has a thickness compatible with a magnetic card reader.

Figure 4 shows an electronic transaction card and a card reader. Electronic transaction card 410 is a card having a stripe compatible with a magnetic card reader. For example, electronic transaction card 410 may be electronic transaction card 104 (Figure 1), electronic transaction card 220 (Figure 2A), electronic transaction card 300 (Figure 3), or any other electronic transaction card described herein. Magnetic card reader 420 is a card reader compatible with magnetic cards. For example, magnetic card reader 420 may operate as part of a merchant point-of-sale terminal, an access control device, or the like. When a magnetic card is swiped through magnetic card reader 420, one or more time-varying magnetic fields are produced relative to the location of a magnetic read head (not shown) in magnetic card reader 420.

In the operation depicted in Figure 4, electronic transaction card 410 is swiped through magnetic card reader 420. During the swiping operation, electronic transaction card 420 produces one or more time-varying magnetic fields to emulate the swiping of a magnetic card. For example, a swipe sensor within electronic transaction card 410 may detect the swiping action depicted in Figure 4, and a magnetic field producing circuit may generate one or more time-varying magnetic fields as electronic transaction card 410 passes by a magnetic read head in magnetic card reader 420.

Figure 5 shows an intelligent electronic device, an electronic transaction card, and a magnetic card reader. Electronic transaction card 510 is shown being swiped through magnetic card reader 520 while attached to intelligent electronic device 500. The operation depicted in Figure 5 represents a transaction occurring while electronic transaction card 510 is coupled to an add-on slot of intelligent electronic device 500.

Figure 6 shows an adapter for use with an electronic transaction card. Adapter 600 includes a body portion having dimensions "*w*" and "*l*", and a receiving portion shown at 610. Adapter 600 is useful to receive an electronic transaction card at receiving portion 610 to provide a larger card having the functionality of an electronic transaction card. For example, in some embodiments of the present invention, dimensions *w* and *l* are compatible with swallow-type magnetic card readers, and a combination of adapter 600 an electronic transaction card may be compatible with such readers.

Receiving portion 610 may include an interface compatible with a connector on an electronic transaction card. For example, an electronic transaction card may have an interface that is compatible with both an add-on slot of an electronic transaction device and receiving portion 610 of adapter 600.

Figure 7 shows adapter 600 having an electronic transaction card 710 coupled thereto. Electronic transaction card 710 includes a stripe capable of emitting one or more time-varying magnetic fields as described above. The combination of electronic transaction card 710 and adapter 600 allow the

functionality of electronic transaction card 710 to be useful in the larger form factor of adapter 600.

In some embodiments, adapter 600 includes active or passive circuitry in support of the operation of electronic transaction card 710. For example, adapter 600 may include electrical contacts, a battery, an integrated circuit, or other circuits. Also for example, adapter 600 may include one or more swipe sensors to provide a swiping indication to electronic transaction card 710.

Figure 8 shows an adapter having a smartcard interface 810. In embodiments represented by Figure 8, an adapter may be utilized to perform a transaction involving a smartcard reader while utilizing an electronic transaction card. For example, an electronic transaction card may be coupled to adapter 800 at receiving portion 820, and the electronic transaction card may provide data useful for a smartcard transaction.

Figure 9 shows an electronic transaction card having a smartcard interface. Electronic transaction card 900 includes electrical contacts 908 and 910. Electrical contacts 908 are similar to electrical contacts 108 (Figure 1). For example, electrical contacts 908 may be compatible with an add-on slot of an intelligent electronic device such as intelligent electronic device 102 (Figure 1). Electrical contacts 910 are arranged to provide the communications interface to a smartcard reader.

In some embodiments, electronic transaction card 900 includes a smartcard interface as well as a stripe to produce the time-varying magnetic field. For example, as shown in figure 10, the backside of electronic transaction card 900 may include stripe1010. The various electronic transaction cards described herein may include a stripe, a smartcard interface, or a combination thereof.

Figure 11 shows an adapter in combination with an electronic transaction card. Adapter 1100 is shown having electronic transaction card 900 coupled in a recessed portion on a side having dimension *w*. In some embodiments, this configuration places electrical contacts 910 at a location expected by smartcard readers.

Figure 12 shows an adapter having an aperture to receive an electronic transaction card. Adapter 1200 includes aperture1210 to receive an electronic transaction card. In some embodiments, aperture 1210 passes completely through adapter 1200, and in other embodiments, aperture 1210 is a recessed portion on the face of adapter 1200. Adapter 1200 may receive electronic transaction cards having a stripe, a smartcard interface, or a combination of the two.

Figure 13 shows and adapter having a body portion 1300, a recessed portion 1310, and stripe 1320. Recessed portion 1310 may receive an electronic transaction card as described above with respect to Figures 6-7. Further, stripe 1320 may be utilized to communicate with a magnetic card reader. For example, adapter 1300 may include a magnetic field producing circuit such as magnetic field producing circuit 312 (Figure 3) to produce a time-varying magnetic field. In operation, an electronic transaction card may be coupled to adapter 1300 at recessed portion 1310, and provide transaction information to be used by stripe 1320 for a transaction with a magnetic card reader. In some embodiments, an electronic transaction card having neither a stripe nor a smartcard interface may be coupled to adapter 1300 at recessed portion 1310 to effect a transaction using stripe 1320.

The various adapters shown in the previous figures may have recessed portions, apertures, or stripes anywhere on the adapter without departing from the scope of the present invention. For example, in some embodiments, a recessed portion may be on the side of the adapter having a smaller dimension, and in other embodiments a recessed portion may be on the side of the adapter having a larger dimension. Also for example, in some embodiments, a stripe may be on the side of the adapter having a smaller dimension, and in other embodiments a stripe may be on the side of the adapter having a larger dimension.

Figure 14 shows an electronic transaction card. Electronic transaction card 1400 includes stripe 1410 and add-on slot compatible portion 1402. Add-on slot compatible portion 1402 includes electrical contacts 1408 to communicate with an add-on slot in an intelligent electronic device. For example, add-on slot compatible

portion 1402 may be physically and electrically compatible with add-on slot 110 (Figure 1) or add-on slot 210 (Figure 2A).

Electronic transaction card 1400 may include any of the circuits, features, or functionality described herein. For example, electronic transaction card 1400 may include magnetic field producing circuits, swipe sensors, processing devices, volatile and nonvolatile memory, various interfaces, and electrical contacts.

Electronic transaction card 1400 is shown having stripe 1410 along an edge having dimension "*l*." In some embodiments, electronic transaction card 1400 may have stripe 1410 along an edge other than that shown in Figure 14.

In operation, electronic transaction card 1400 may be left coupled to an electronic transaction device when being swiped through a magnetic card reader, similar to the operation shown in Figure 5. Further, electronic transaction card 1400 may be removed from an intelligent electronic device prior to being swept through a magnetic card reader, similar to the operation shown in Figure 4.

Figure 15 shows an electronic transaction card and an adapter in combination. The combination of electronic transaction card 1400 and adapter 1500 form a card having dimensions "*w*" and "*l*" as described above with reference to previous figures. The resulting card may be suitable for swallow-type magnetic card readers.

Figure 16 shows a combination electronic transaction card and adapter 1610 being inserted into a swallow-type magnetic card reader. As shown in Figure 16, the swallow-type magnetic card reader is part of an automated teller machine (ATM), but this is not a limitation of the present invention. For example, the swallow-type reader may be part of a point-of-sale device, an access entry device, or any other type of device capable of incorporating a swallow-type magnetic card reader.

Figure 17 shows a combination electronic transaction card and adapter being swiped through a magnetic card reader. Adapter 1710 and electronic transaction card 1720 are shown being swiped through magnetic card reader 1730. Electronic transaction card 1720 maybe any of the electronic transaction card embodiments

described herein. For example, electronic transaction card 1720 may include a stripe, a smartcard interface, or a combination of the two. Although adapter 1710 is shown as an adapter having a recessed portion on one side, the combination adapter/card in Figure 17 represents any of the adapter/ card combinations described herein. For example, adapter 1710 may be any of adapters 600 (Figures 6,7), adapter 800 (Figure 8), adapter 1100 (Figure 11), adapter 1200 (Figure 12), adapter 1300 (Figure 13), or adapter 1500 (Figure 15).

Figure 18 shows a financial transaction card. Financial transaction card 1800 includes stripe 1802, financial card circuits 1804, memory card emulation circuitry 1806, and memory card compatible interface 1808. Financial transaction card 1800 is an example of a financial card that might be issued by a bank or other financial institution. For example, financial transaction card 1800 might be a debit card, a credit card, a stored value card, or other card issued for the purposes of financial transactions.

Financial card circuits 1804 interact with stripe 1802 to produce time-varying magnetic fields compatible with a magnetic card reader. For example, financial card circuits 1804 and stripe 1802 may provide financial transaction data to a point-of-sale terminal. Financial transaction card 1800 also includes memory card emulation circuitry 1806 to emulate the operation of a memory card. The combination of memory card emulation circuitry 1806 and memory card compatible interface 1808 allow financial transaction card 1800 to perform as a memory card. For example, memory card compatible interface 1808 may be compatible with a memory card interface in an add-on slot of an intelligent electronic device.

Figure 19 shows a memory card. Memory card 1900 includes memory card compatible interface 1930, memory card circuits 1920, financial card emulation circuitry 1910, and stripe 1902. Memory card 1900 is an example of a card that may be fabricated and sold by a memory card manufacturer or a manufacturer that is in the business of selling electronic peripheral devices. By including financial card emulation circuitry 1910 and stripe 1902 in memory card 1900, the manufacturer of memory card 1900 may add features desired by consumers. For example, the

combination of stripe 1902 and financial card emulation circuitry 1910 may emulate the operation of a financial card such as a credit card, debit card, stored value card, or the like.

Figure 20 shows a block diagram of a combination memory card and electronic transaction card. Card 2000 includes memory 2010, processing element 2020, magnetic/smartcard circuitry 2030, card reader interface 2040, memory card circuitry 2050, and memory card slot compatible interface 2060. Processing element 2020 may be any processing element suitable to communicate with memory 2010 and the other blocks shown in Figure 20. Magnetic/smartcard circuitry 2030 may include circuits to produce time-varying magnetic fields or signals compatible with a smart card reader. Card reader interface 2040 may include a stripe as described above, or may include electrical contacts compatible with a smartcard reader. Memory card circuitry 2050 may be any type of memory circuitry accessible by an intelligent electronic device. The intelligent electronic device may access memory card circuitry 2050 through memory card slot compatible interface 2060.

Memory 2010 is shown having card software 2012 and application software 2014. In some embodiments, card 2000 is sold or distributed having both card software 2012 and application software 2014 in memory 2010. For example, memory 2010 may be nonvolatile memory having card software 2012 for execution by processing element 2020. Also for example, memory 2010 may have application software 2014 meant to be installed on a device other than card 2000. Application software 2014 may include drivers, user interface software, single transaction account number (STAN) generation software, or any other software that may be installed on a device other than card 2000.

Application software 2014 may operate in any of multiple languages on multiple operating systems. For example, application software 2014 may provide a user interface in any regional language. Also for example, application software 2014 may run on any operating system (OS).

Figure 21 shows a block diagram of how card 2000 (Figure 20) may be utilized. A card issuer 2110 may issue card 2000 to a cardholder 2130. As issued by card issuer 2110, card 2000 may include card software and application software as shown in Figure 21. Cardholder 2130 may couple card 2000 with intelligent electronic device 2140 and install application software on the intelligent electronic device. For example, intelligent electronic device 2140 may be a mobile phone capable of executing application software, and card 2000 may supply application software to be installed on the mobile phone. Also for example, intelligent electronic device 2140 may be a non-telephonic device such as a personal digital assistant (PDA), or other dedicated hardware, capable of receiving card 2000 in an add-on slot.

Figure 22 shows a block diagram of a combination memory card and electronic transaction card. Card 2200 includes processing element 2020, magnetic/smartcard circuitry 2030, card reader interface 2040, memory card circuitry 2050, and memory card slot compatible interface 2060, all of which are described above with reference to Figure 20. Card 2200 also includes nonvolatile memory 2210 and volatile memory 2220. As shown in Figure 22, nonvolatile memory 2210 includes card software 2212 to be executed by processing element 2020. Also as shown in Figure 22, card 2200 includes volatile memory 2220 having financial transaction data 2222 held therein. Financial transaction data 2222 may be programmed into volatile memory 2220 by processing alignment 2020 in response to communications from an intelligent electronic device coupled to memory card slot compatible interface 2060. For example, a mobile phone executing single transaction account number generation software may provide a single transaction account number as financial transaction data that gets stored in volatile memory 2220 in preparation for a transaction. In other embodiments, financial transaction data 2222 represents two, three, four, or more time-varying magnetic fields to be generated by the combination of magnetic/smartcard circuitry 2030 and card reader interface 2040.

Figure 23 shows a block diagram of a phone and a card. Phone 2310 may be a cellular telephone, and card 2350 may be any of the electronic transaction card embodiments described herein. Phone 2310 includes display 2312, processor 2314, single transaction account number (STAN) generation software 2316, and authentication software 2318. Card 2350 includes processor 2352, card software 2354, financial transaction data 2356, and point-of-sale (POS) interface 2358.

Single transaction account number generation software 2316 may be installed on the phone 2310 when card 2350 is inserted in a memory slot. For example, referring now back to Figures 20 and 21, STAN generation software 2316 may correspond to application software 2014. Authentication software 2318 may only allow authorized users access to phone 2310 and/or card 2350.

In operation, a user interacting with phone 2310 may gain access to features by satisfying requirements of authentication software 2318. Using STAN generation software 2316, a user may generate financial transaction data 2356 which is held on card 2350 in preparation for a transaction. Card 2350 may then interact with a card reader using point-of-sale interface 2358 to effect a transaction. This transaction may be effected with card 2350 coupled to phone 2310 or decoupled from phone 2310. Further, the transaction using card 2350 may be effected while card 2350 is coupled to any of the adapter embodiments described herein.

The following paragraphs provide further disclosure of various invention embodiments. Each embodiment is fully defined by the recitation of the corresponding paragraph, and no other elements are to be considered essential for that particular embodiment. The embodiments include:

A. An apparatus comprising:

a stripe to communicate with a magnetic card reader; and

an interface to communicate with an intelligent electronic device;

wherein the apparatus has dimensions smaller than a credit card.

A1. The apparatus of A wherein the stripe includes circuitry to produce at least one time-varying magnetic field.

A2. The apparatus of A wherein the interface is compatible with an add-on slot in the intelligent electronic device.

A3. The apparatus of A2 wherein the interface comprises a memory card interface.

A4. The apparatus of A further comprising a processing element coupled to the interface and to the stripe.

A5. The apparatus of A4 further comprising a memory element to hold programming information for the stripe.

A6. The apparatus of A4 further comprising an embedded swipe sensor to sense when the stripe is swiped through a magnetic card reader.

A7. The apparatus of A further comprising nonvolatile memory accessible by the intelligent electronic device.

B. A financial card comprising:
a point-of-sale compatible electronic transaction stripe;
a memory card compatible interface; and
memory card emulation circuitry coupled to the memory card compatible interface.

C. A memory card comprising:
a memory card compatible interface;
a point-of-sale compatible electronic transaction stripe; and

financial card emulation circuitry coupled to the point-of-sale compatible electronic transaction stripe.

D. A financial card apparatus comprising:

a point-of-sale compatible portion having a stripe to communicate with a point-of-sale transaction device; and

a memory card compatible portion having at least one electrical contact to communicate with a memory card slot in an intelligent electronic device.

E. A memory card comprising:

a memory card interface operable to couple the memory card to an intelligent electronic device;

a nonvolatile memory device accessible through the memory card interface; and

a stripe operable to communicate with a magnetic card reader.

F. A memory card comprising:

a memory card slot interface; and

circuitry for producing a time-varying magnetic field compatible with a magnetic card reader.

F1. The memory card of F wherein the circuitry is configured to produce a plurality of time-varying magnetic fields compatible with a point-of-sale transaction device.

G. An apparatus comprising:

means for communicating through a memory card slot in an intelligent electronic device;

means for producing at least one time-varying magnetic field to represent financial transaction data; and

means for storing the financial transaction data.

H. A card comprising:

a memory card compatible interface;

a smartcard compatible interface; and

a stripe to produce at least one time-varying magnetic field compatible with a magnetic card reader.

I. A memory card compatible with a memory card slot in a mobile phone, the memory card including nonvolatile memory accessible by the mobile phone, a point-of-sale interface to communicate with a point-of-sale terminal, and volatile memory to hold financial transaction data.

I1. The memory card of I wherein the point-of-sale interface comprises circuitry to produce at least one time-varying magnetic field.

I2. The memory card of I1 further including a processing device coupled to the nonvolatile memory, volatile memory, and point-of-sale interface.

J. An electronic financial transaction device having a thickness compatible with a point-of-sale card reader, a width less than a credit card width, a length less than a credit card length, an electronically programmable stripe situated along the length, and at least one electrical contact to provide an interface to an intelligent electronic device.

J1. The electronic financial transaction device of J wherein the at least one electrical contact comprises a memory card interface compatible with a memory card slot in the intelligent electronic device.

J2. The electronic financial transaction device of J wherein the electronically programmable stripe includes a circuit to emulate a magnetic stripe in a credit card.

J3. The electronic financial transaction device of J2 further comprising a swipe sensor to detect when the electronic financial device is swiped through a point-of-sale terminal.

K. A card comprising:

means for storing financial transaction data;

means for communicating with a memory card slot in an intelligent electronic device; and

means for creating a time-varying magnetic field that represents the financial transaction data.

K1. The card of K wherein the means for storing financial transaction data comprises volatile memory.

K2. The card of K wherein the financial transaction data comprises a single transaction account number.

K3. The card of K further comprising a processing device coupled to read the financial transaction data and influence the operation of the means for creating a time-varying magnetic field.

L. An adapter for use with any of A-K, the adapter comprising:

a body portion having exterior dimensions larger than dimensions of A-G; and

a receiving portion to receive any of A-G, wherein the receiving portion is located on the body portion to expose any of A-G for use in magnetic card reader transactions.

M. An apparatus comprising a body portion with dimensions compatible with a swallow-type magnetic card reader, wherein the body portion includes a memory card compatible area to receive a memory card with magnetic stripe functionality.

M1. The apparatus of M further comprising a smartcard interface.

M2. The apparatus of M further comprising at least one electrical component coupled to the memory card compatible area portion to interface to the memory card.

M3. The apparatus of M wherein the memory card compatible area comprises a recessed portion of at least one side of the apparatus.

M4. The apparatus of M wherein memory card compatible area comprises at least one metallic contact on a periphery of an aperture in the apparatus.

N. A financial card to be used with a magnetic card reader at a point-of-sale, the financial card including a memory card interface to allow the financial card to be inserted in a memory card slot of a mobile phone, and including a stripe compatible with the magnetic card reader, wherein the stripe is shorter than a magnetic credit card stripe.

O. A card compatible with a magnetic card reader and compatible with a memory slot in an intelligent electronic device, the card including software to be installed on the intelligent electronic device.

O1. The card of O wherein the software includes a module for single transaction account number generation.

O2. The card of O1 wherein the software is configured to run on a mobile phone.

O3. The card of O wherein the card comprises:

a memory slot compatible portion; and

a magnetic card reader compatible portion.

O4. The card of O3 wherein the magnetic card reader compatible portion comprises circuitry to produce at least one time-varying magnetic field for use in a financial transaction.

P. A card comprising:

a memory card interface mechanically compatible with a memory card slot in an intelligent electronic device;

a processing device coupled to the memory card interface; and

circuitry to produce a time-varying magnetic field compatible with a point-of-sale device.

Q. A card comprising:

a memory card interface electrically compatible with a memory card slot in an intelligent electronic device;

a processing device coupled to the memory card interface; and

circuitry to produce a time-varying magnetic field compatible with a point-of-sale device.

Q1. Any of the cards of P-Q further comprising nonvolatile memory exposed through the memory card interface.

Q2. Any of the cards of P-Q further comprising volatile memory to hold financial transaction information.

Q3. Any of the cards of P-Q further comprising a software component that when executed by the processing device causes the circuitry to produce at least one time-varying magnetic field representing the financial transaction information.

Q4. Any of the cards of P-Q further comprising a visible stripe at which the at least one time-varying magnetic field emanates.

Q5. Any of the cards of P-Q further comprising a battery.

Q6. Any of the cards of P-Q further comprising a capacitor to provide power to the card.

Q7. The card of Q wherein the card has a size substantially equivalent to a credit card.

R. A credit card sized adapter to receive any of the cards of P-Q.

R1. The adapter of R wherein the credit card sized adapter includes a smartcard interface.

R2. The adapter of R wherein the adapter includes a first edge having a width and a second edge having a length, wherein the second edge includes a recessed portion to accept the card.

R3. The adapter of R wherein the credit card sized adapter includes a first edge having a width and a second edge having a length, wherein the first edge includes a recessed portion to accept the card.

S. A combination financial card and memory card apparatus comprising:

electrical contacts to provide an interface to a mobile phone;

a transaction stripe to produce at least one time-varying magnetic field representing transaction information;

a processing device; and

a software component to receive the transaction information from the mobile phone;

wherein the electrical contacts are provided on a physical portion of the combination financial card and memory card apparatus having dimensions compatible with a memory card slot.

S1. The combination financial card and memory card apparatus of S further comprises an application software component to be installed on the mobile phone.

T. In combination:

a memory card having a transaction stripe compatible with a magnetic card reader; and

a credit card sized adapter to receive the memory card and to expose the transaction stripe for use in magnetic card reader transactions.

U. In combination:

a memory card having an interface compatible with a memory card slot in a mobile phone and a smartcard interface; and

a credit card sized adapter to receive the memory card and to expose the smartcard interface for use in smartcard transactions.

V. A financial transaction system comprising:

a mobile phone having a memory card slot;

a memory card compatible with the memory card slot, wherein the memory card includes circuitry to transmit financial transaction data to a point-of-sale device; and

a software component to produce single transaction account numbers for use as financial transaction data.

W. A system comprising:

a wearable intelligent electronic device having a card slot; and

a card comprising a card slot interface and circuitry for producing a time-varying magnetic field compatible with a magnetic card reader.

Although the present invention has been described in conjunction with certain embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art readily understand. Such modifications and variations are considered to be within the scope of the invention and the appended claims.

What is claimed is:

1. A mobile device comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card; and

a processor coupled to the circuitry to cause the circuitry to produce a time-varying magnetic field that represents a single transaction account number.

2. The mobile device of claim 1 wherein the mobile device comprises a mobile phone.

3. The mobile device of claim 1 wherein the time-varying magnetic field mimics a swipe of a magnetic credit card.

4. The mobile device of claim 1 wherein the single transaction account number represents financial data.

5. The mobile device of claim 4 wherein the financial data comprises credit card data.

6. The mobile device of claim 1 further comprising smartcard circuitry coupled to the processor.

7. The mobile device of claim 1 wherein the single transaction account number represents access data.

8. The mobile device of claim 1 wherein the time-varying magnetic field mimics a swipe of a magnetic access card.

9. The mobile device of claim 1 wherein the time-varying magnetic field is used to perform point-of-sale transactions.

10. A mobile device comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card;

smartcard circuitry for performing transactions using single transaction account numbers; and

a processor coupled to the smartcard circuitry and the circuitry to produce a time-varying magnetic field.

11. The mobile device of claim 10 wherein the mobile device comprises a mobile phone.

12. The mobile device of claim 10 wherein the smartcard circuitry is configured to perform point-of-sale transactions.

13. The mobile device of claim 10 wherein the transactions are financial transactions.

14. The mobile device of claim 10 wherein the time-varying magnetic field mimics a swipe of a magnetic credit card.

15. The mobile device of claim 10 wherein the single transaction account numbers have a pre-defined sequence.

16. The mobile device of claim 10 wherein the single transaction account numbers comprise pre-assigned single-use transaction numbers.

17. A mobile phone comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card;

circuitry to enable use of single transaction account numbers; and

a processor coupled to the circuitry to produce a time-varying magnetic field and to the circuitry to enable use of single transaction account numbers, the processor configured to cause a time-varying magnetic field to be produced that represents a single transaction account number.

18. The mobile phone of claim 17 wherein the circuitry to enable use of single transaction account numbers comprises smartcard circuitry.

19. The mobile phone of claim 17 wherein the single transaction account numbers have a pre-defined sequence.

20. The mobile phone of claim 17 wherein the single transaction account numbers comprise pre-assigned single-use transaction numbers.

Abstract of Disclosure

An electronic transaction card communicates with an add-on slot of an intelligent electronic device. The add-on slot may be a memory card slot. The intelligent electronic device may be a mobile phone or other device with or without network connectivity. The electronic transaction card may have magnetic field producing circuitry compatible with magnetic card readers, smartcard circuitry, other point-of-sale interfaces, or any combination thereof.

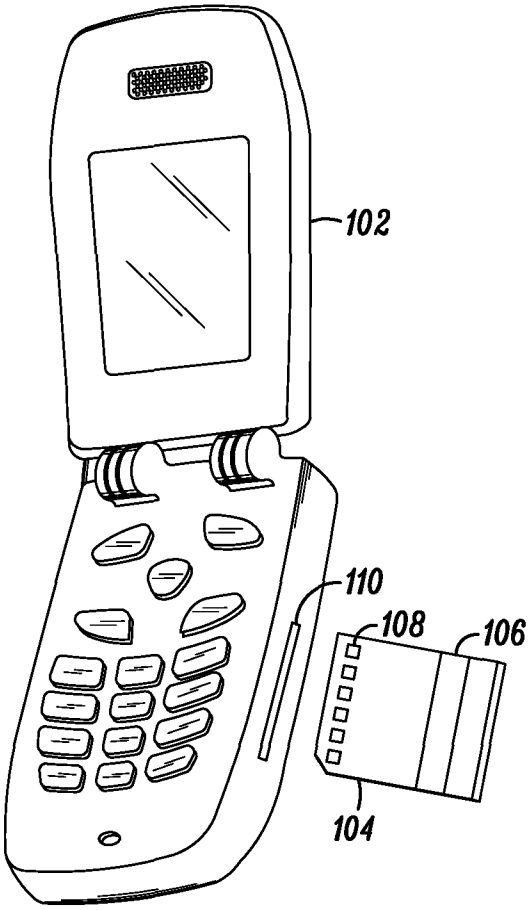


FIG. 1

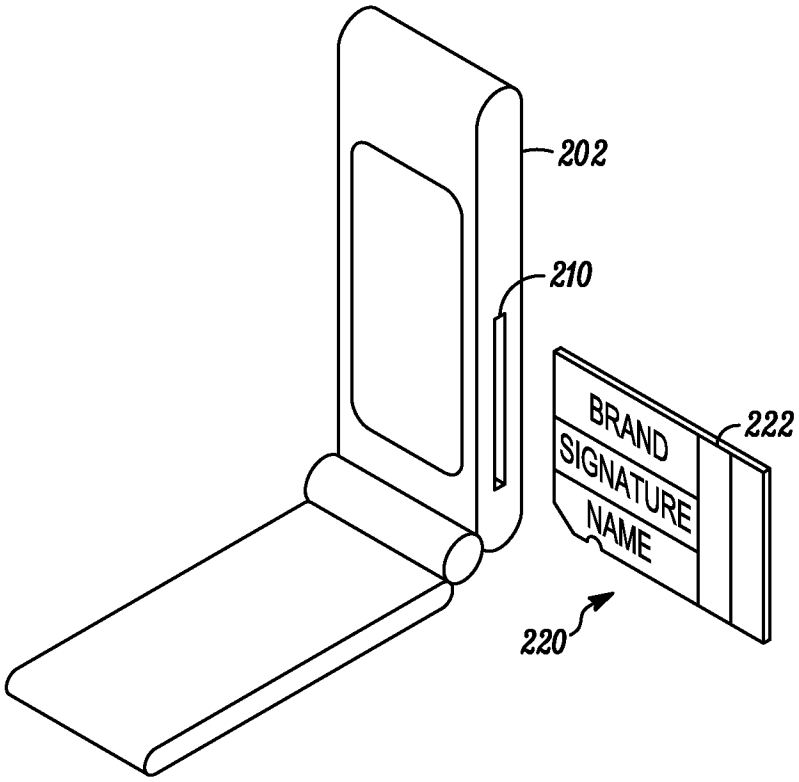


FIG. 2A

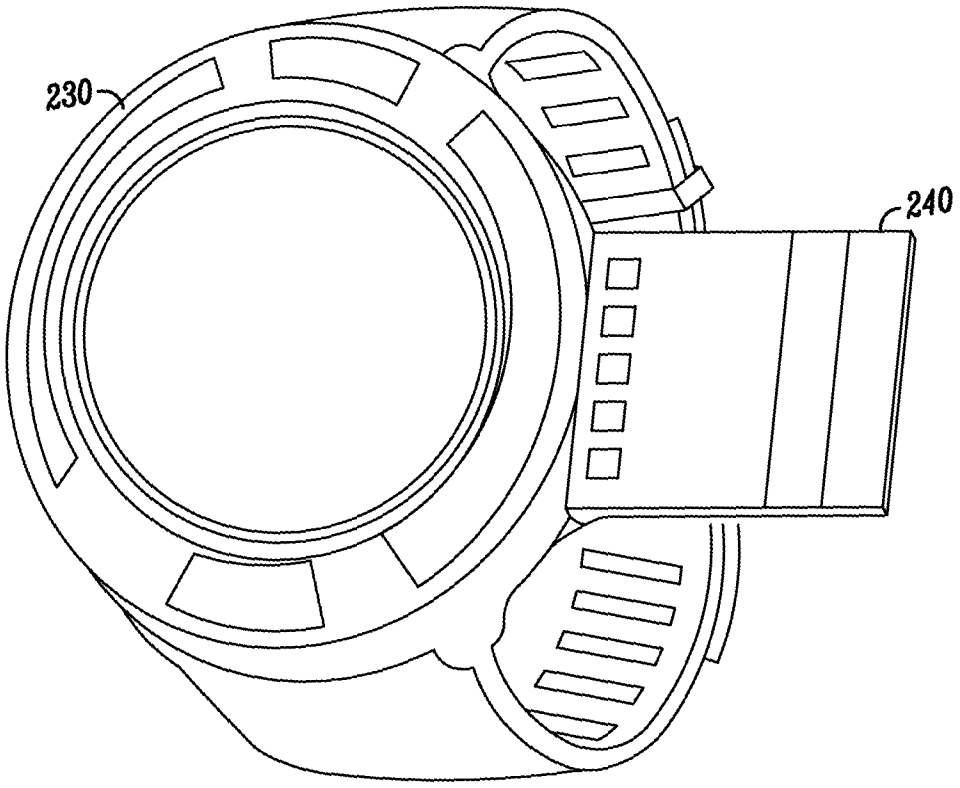


FIG. 2B

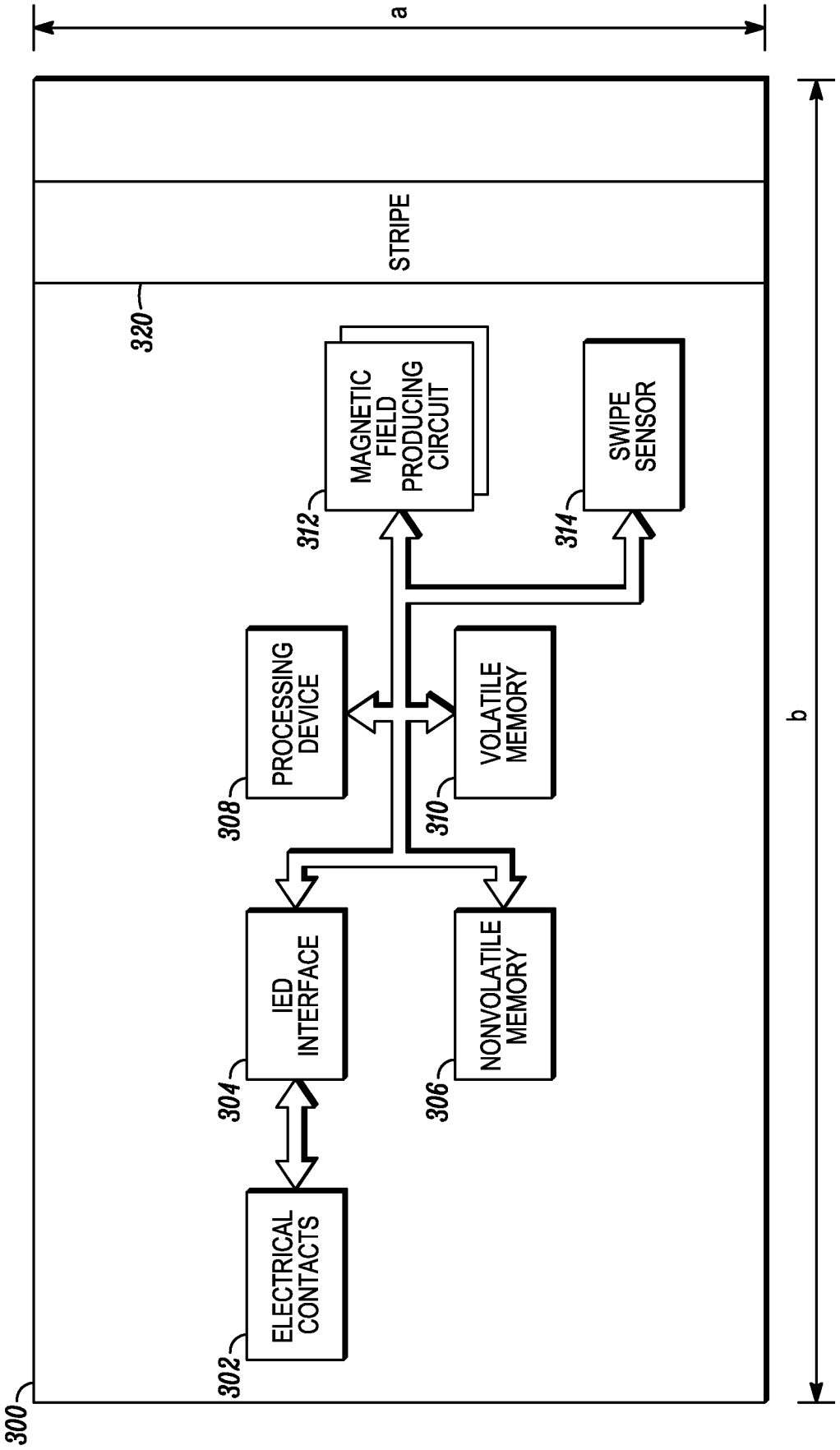

a
b
STRIPE
320
MAGNETIC FIELD PRODUCING CIRCUIT
312
SWIPE SENSOR
314
PROCESSING DEVICE
308
VOLATILE MEMORY
310
IED INTERFACE
304
NONVOLATILE MEMORY
306
ELECTRICAL CONTACTS
302
300

FIG. 3

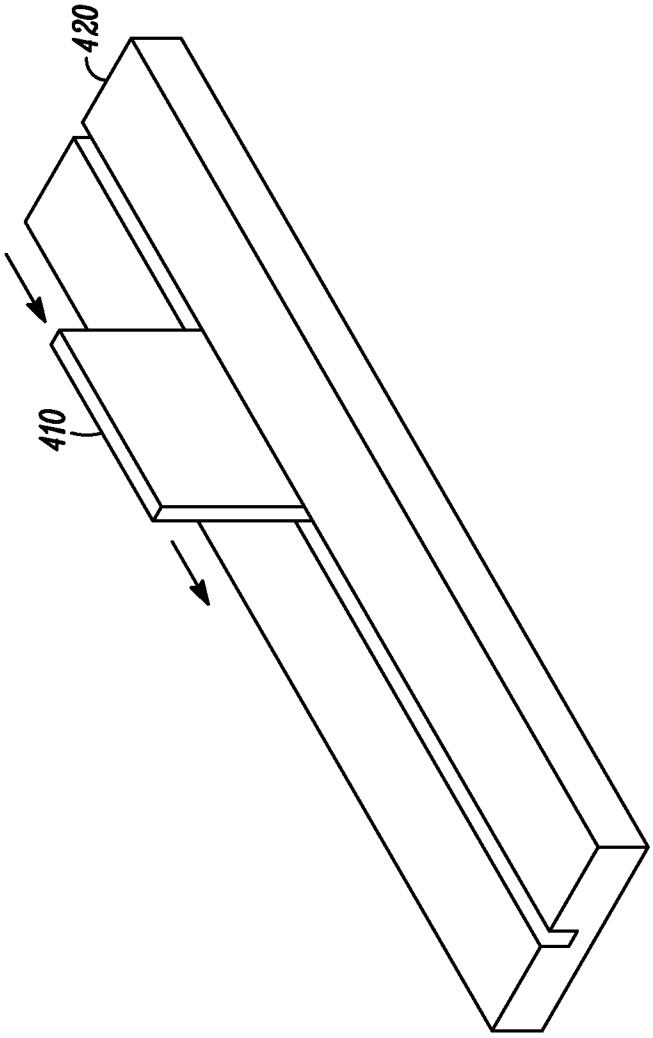


FIG. 4

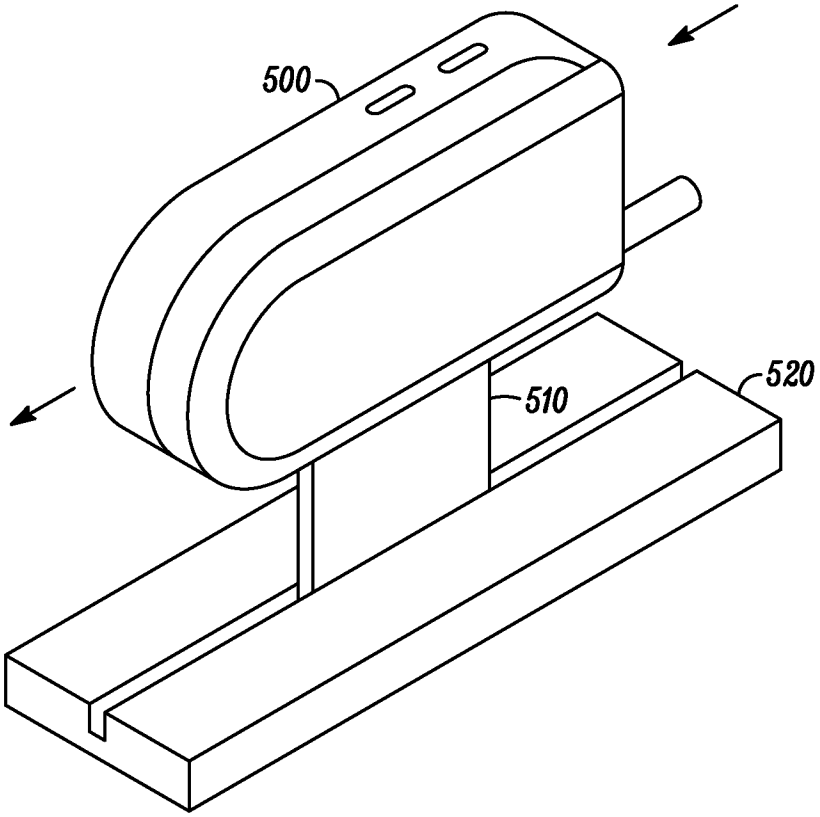


FIG. 5

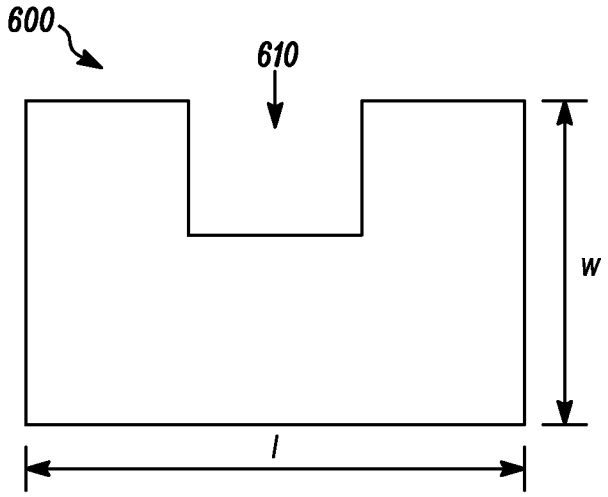


FIG. 6

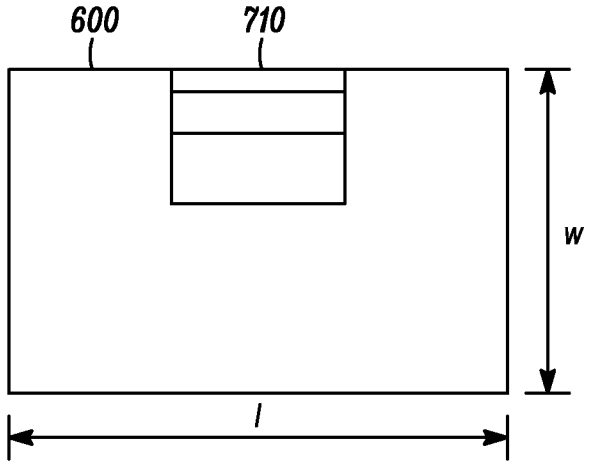


FIG. 7

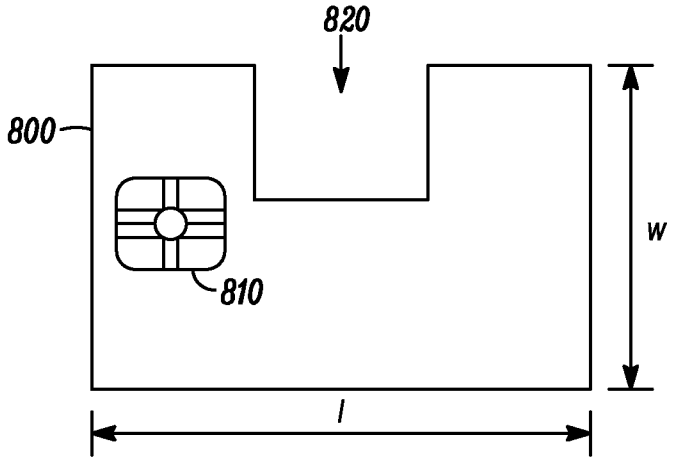


FIG. 8

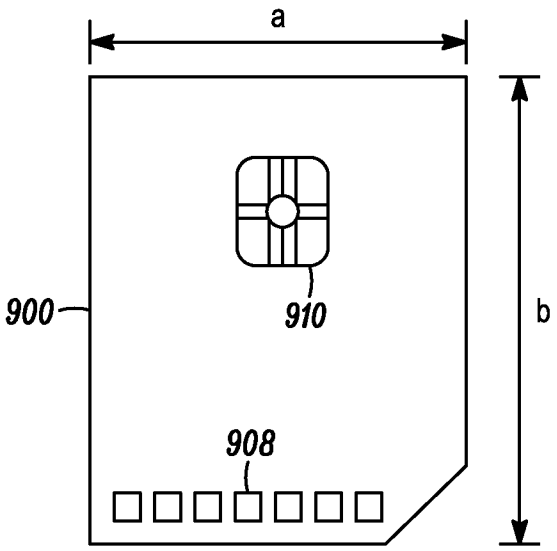


FIG. 9

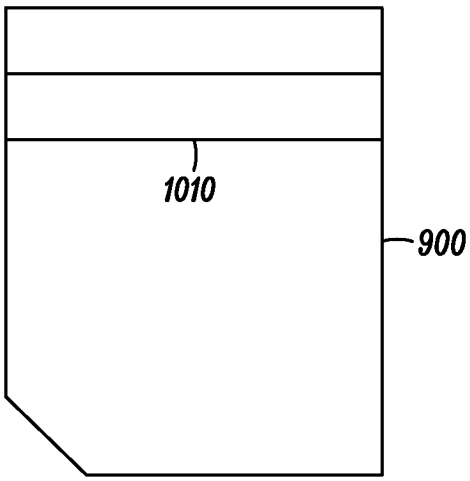


FIG. 10

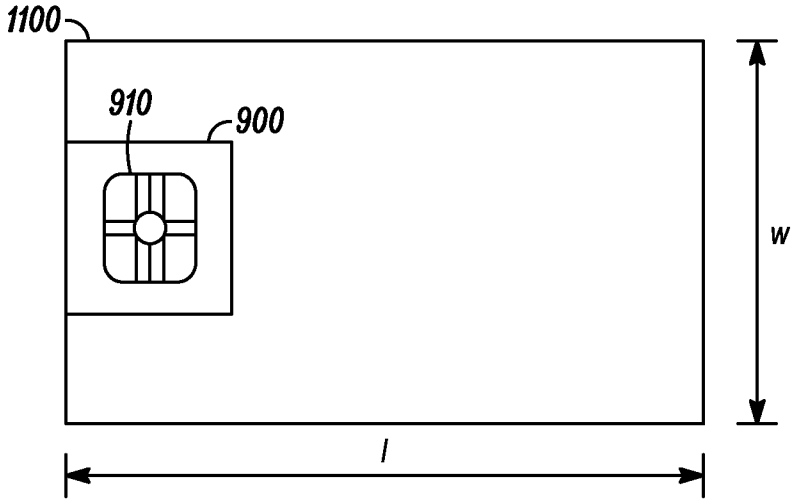


FIG. 11

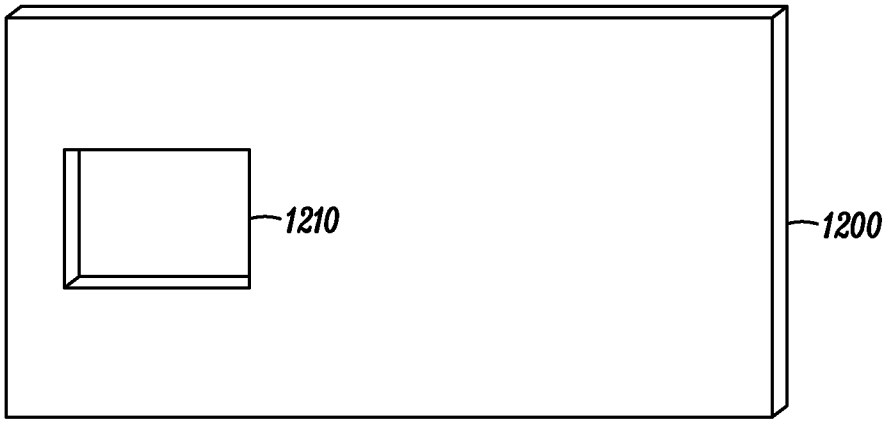


FIG. 12

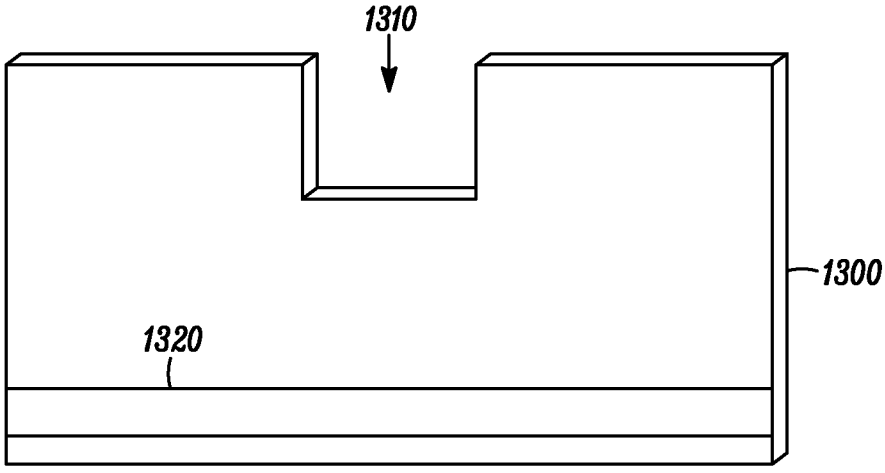


FIG. 13

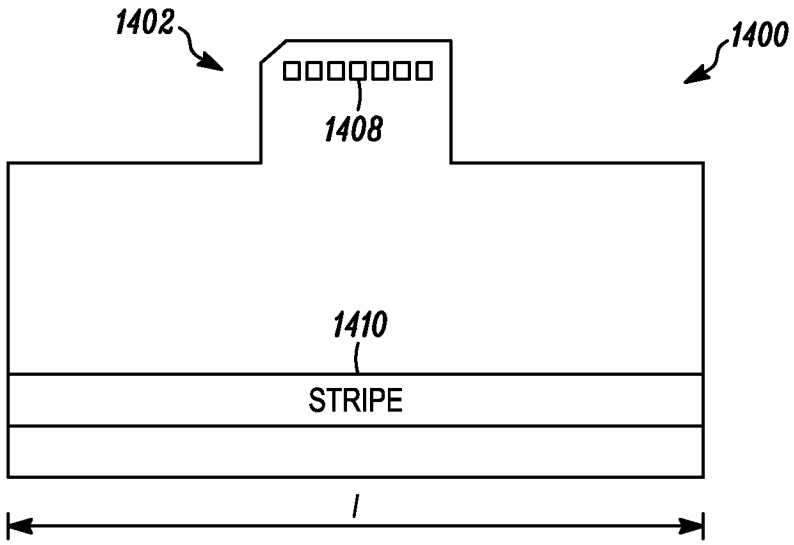


FIG. 14

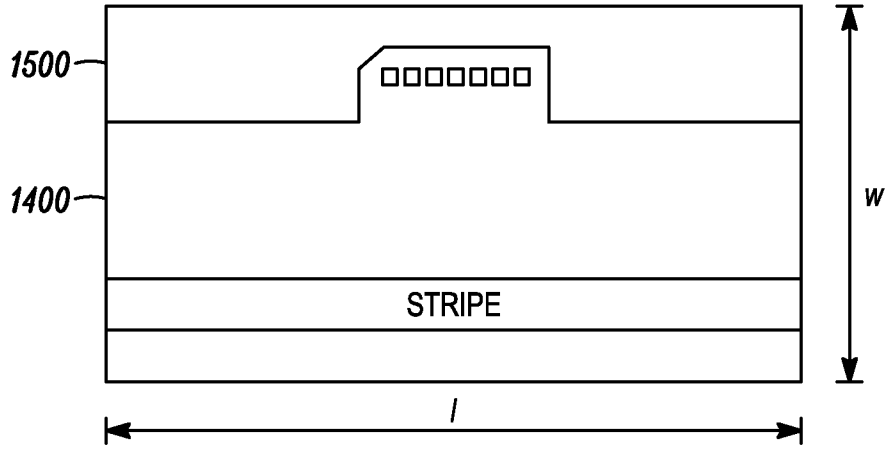


FIG. 15

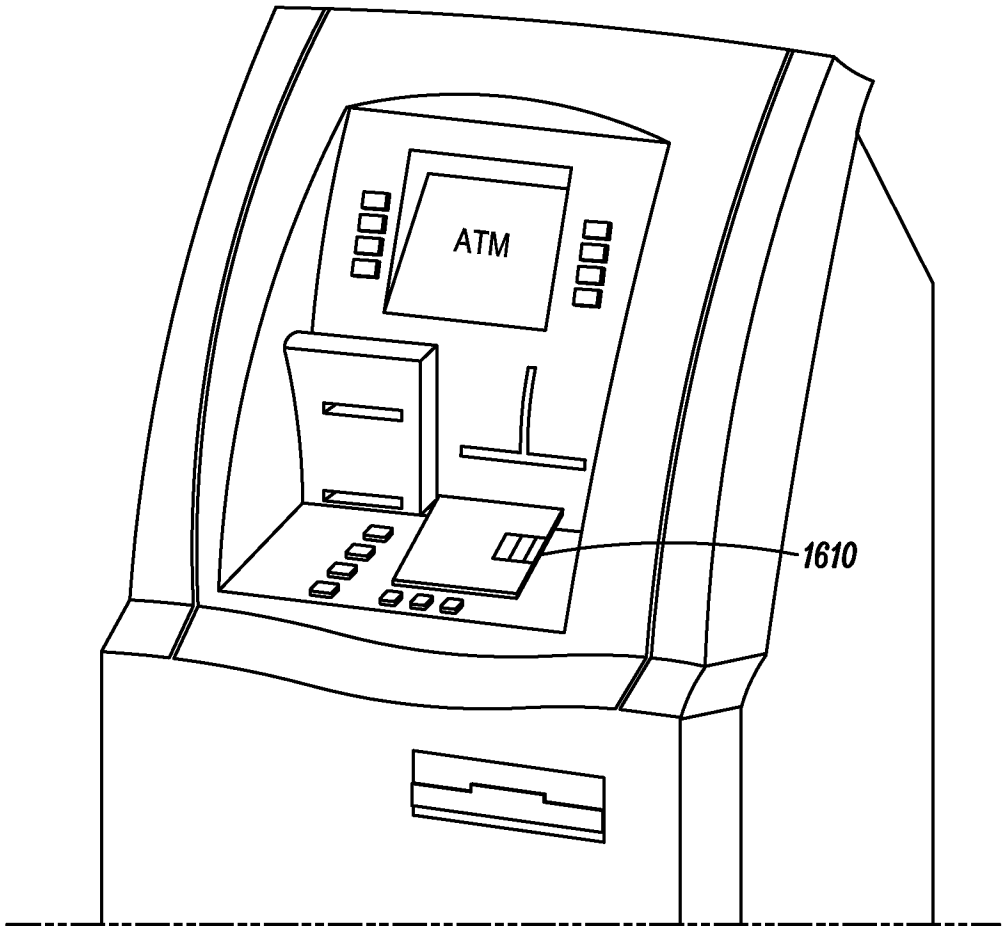


FIG. 16

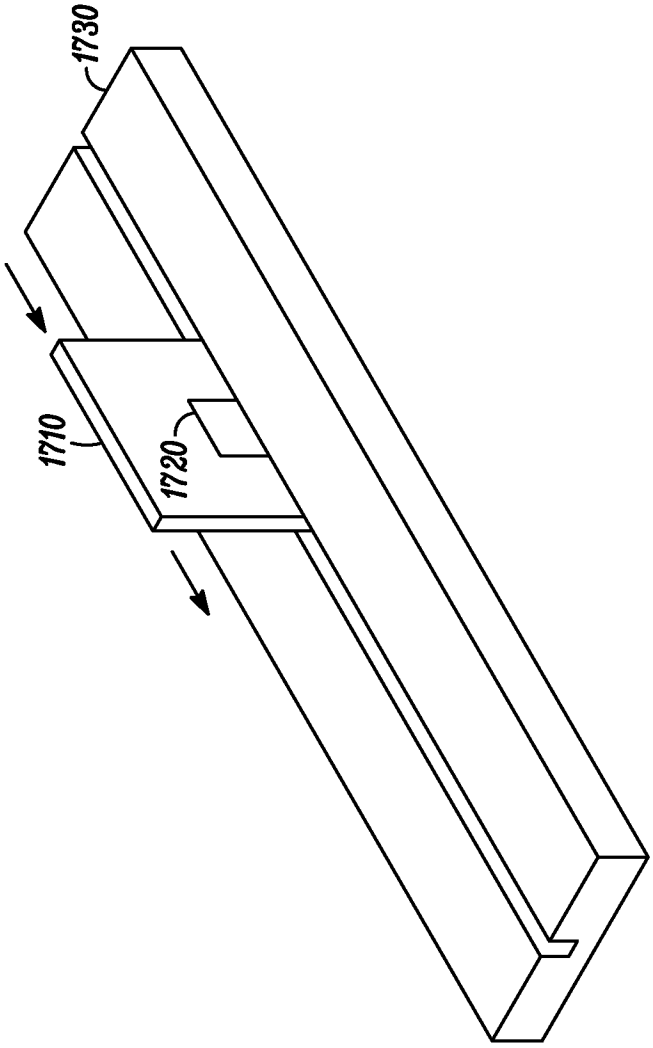


FIG. 17

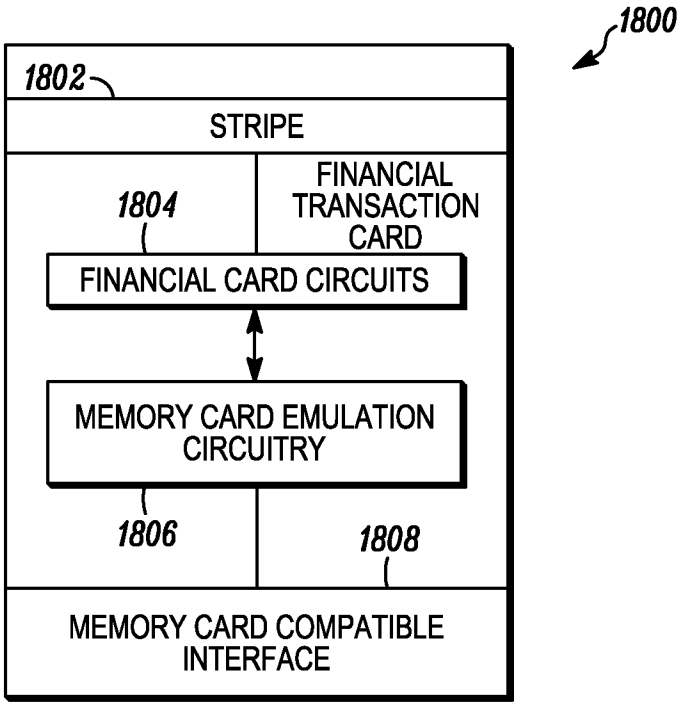

1800
1802
STRIPE
1804
FINANCIAL TRANSACTION CARD
FINANCIAL CARD CIRCUITS
MEMORY CARD EMULATION CIRCUITRY
1806
1808
MEMORY CARD COMPATIBLE INTERFACE

FIG. 18

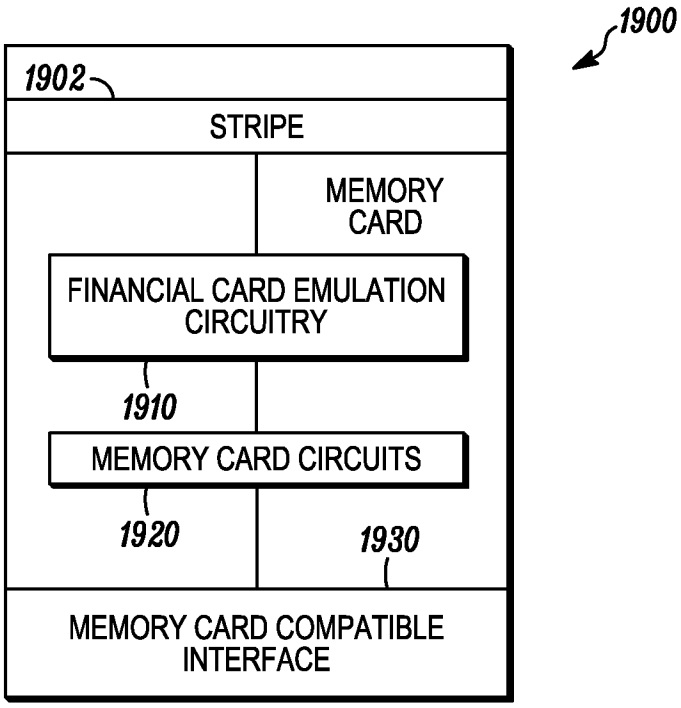

1900
1902
STRIPE
MEMORY CARD
FINANCIAL CARD EMULATION CIRCUITRY
1910
MEMORY CARD CIRCUITS
1920
1930
MEMORY CARD COMPATIBLE INTERFACE

FIG. 19

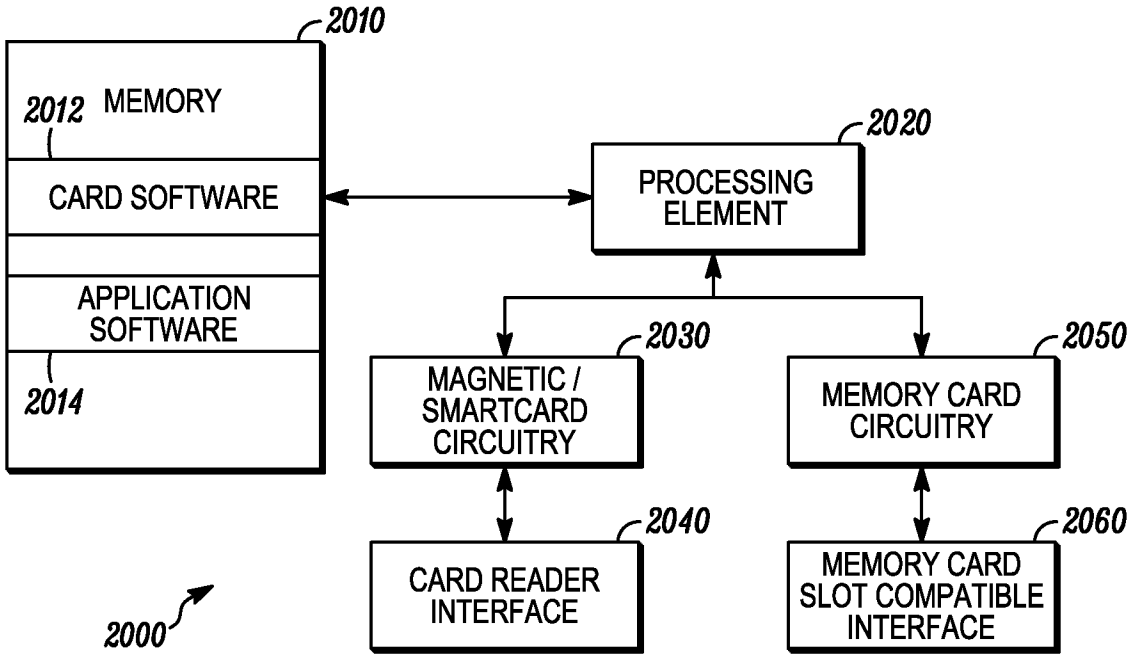

2010
2012 MEMORY
CARD SOFTWARE
APPLICATION SOFTWARE
2014
2020
PROCESSING ELEMENT
2030
MAGNETIC / SMARTCARD CIRCUITRY
2050
MEMORY CARD CIRCUITRY
2040
CARD READER INTERFACE
2060
MEMORY CARD SLOT COMPATIBLE INTERFACE
2000

FIG. 20

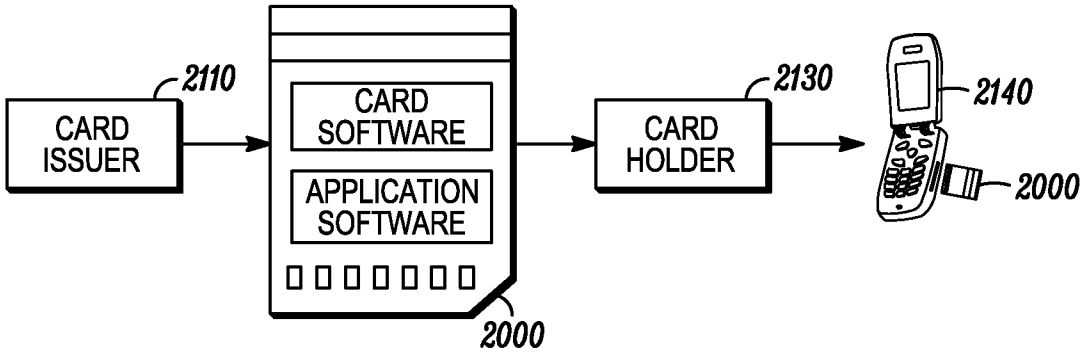

2110
CARD ISSUER
CARD SOFTWARE
APPLICATION SOFTWARE
2000
2130
CARD HOLDER
2140
2000

FIG. 21

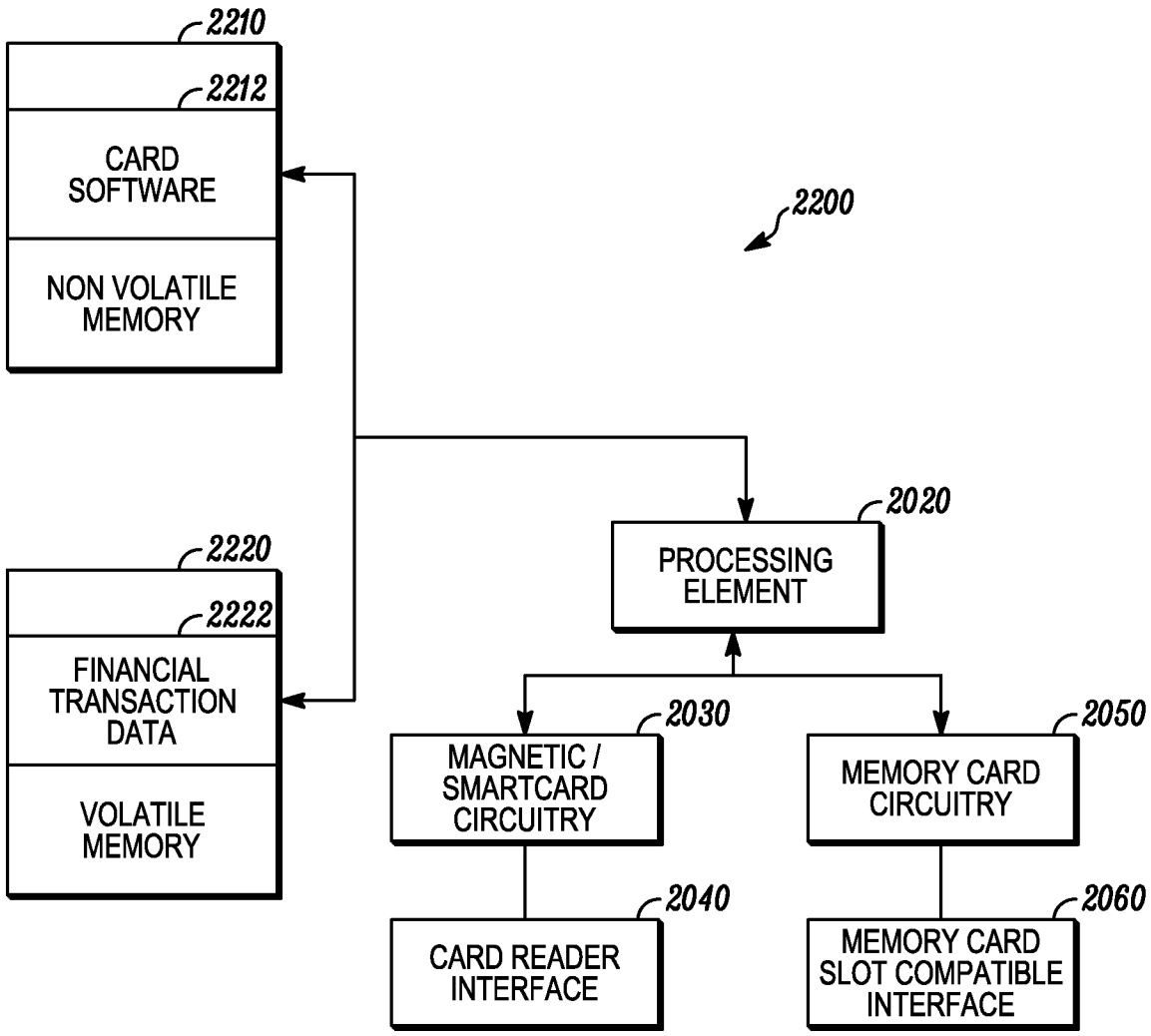

2210
2212
CARD SOFTWARE
NON VOLATILE MEMORY
2200
2020
PROCESSING ELEMENT
2220
2222
FINANCIAL TRANSACTION DATA
VOLATILE MEMORY
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MAGNETIC / SMARTCARD CIRCUITRY
2050
MEMORY CARD CIRCUITRY
2040
CARD READER INTERFACE
2060
MEMORY CARD SLOT COMPATIBLE INTERFACE

FIG. 22

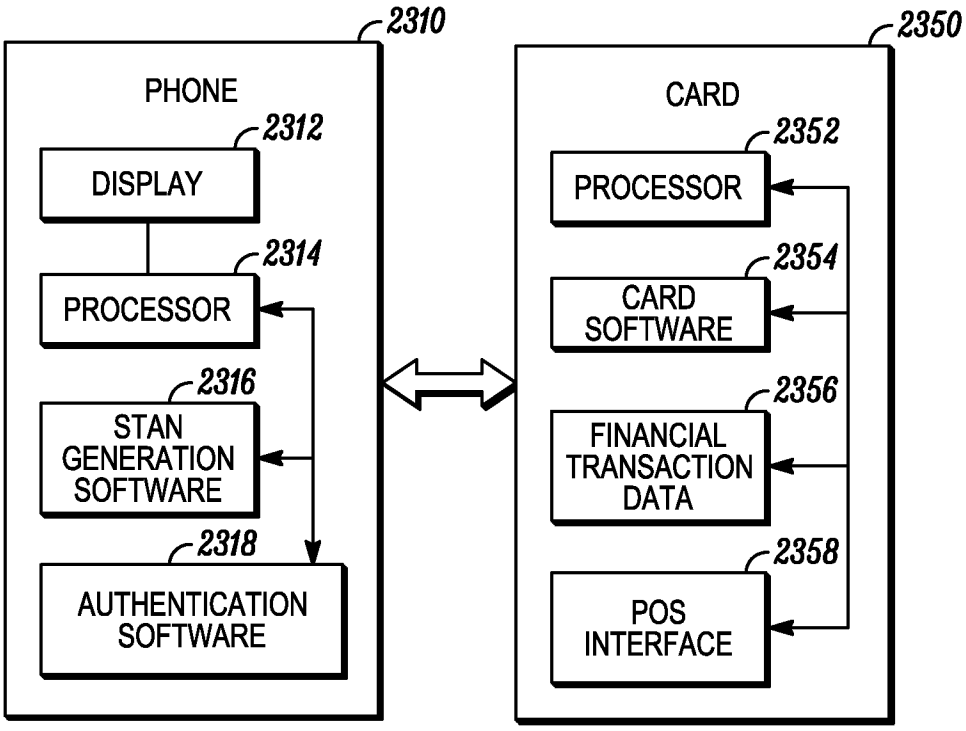

2310
PHONE
2312
DISPLAY
2314
PROCESSOR
2316
STAN GENERATION SOFTWARE
2318
AUTHENTICATION SOFTWARE
2350
CARD
2352
PROCESSOR
2354
CARD SOFTWARE
2356
FINANCIAL TRANSACTION DATA
2358
POS INTERFACE

FIG. 23

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT3494309

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
SIVA G NARENDRA	06/23/2015
THOMAS N SPITZER	06/23/2015
PRABHAKAR TADEPALLI	06/23/2015

RECEIVING PARTY DATA

Name:	TYFONE, INC.
Street Address:	5331 SW MACADAM AVE
Internal Address:	STE 251
City:	PORTLAND
State/Country:	OREGON
Postal Code:	97239

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	14833113

CORRESPONDENCE DATA

Fax Number:

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 612-747-2346
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Address Line 2: SUITE 251
Address Line 4: PORTLAND, OREGON 97239

ATTORNEY DOCKET NUMBER:	115.001US9.4
NAME OF SUBMITTER:	DANA B. LEMOINE
SIGNATURE:	/Dana B. LeMoine/
DATE SIGNED:	08/23/2015
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 6

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United States Patent Application

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD

As a below named inventor, I hereby declare that:

This declaration is directed to the attached application.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the application, including the claims.

I am aware of the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WHEREAS, I,

Siva G. Narendra residing at 7180 SW 84th Ave Portland OR US

made certain new and useful inventions and improvements for which I filed an application for Letters Patent of the United States as identified above;

AND WHEREAS, Tyfone, Inc, a corporation organized and existing under and by virtue of the laws of the State of Oregon, and having an office and place of business at 5331 SW Macadam Ave., Suite 251, Portland, OR 97239 (hereinafter "Assignee"), is desirous of acquiring the entire right, title and interest in and to said inventions, improvements and application and in and to the Letters Patent to be obtained therefore;

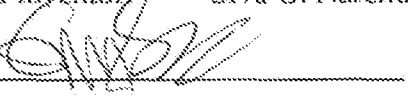
NOW, THEREFORE, to all whom it may concern, be it known that for good and valuable consideration, the receipt and sufficiency whereof is hereby acknowledged, I have sold, assigned, and transferred, and by these presents do sell, assign and transfer unto said Assignee, its successors or assigns, the entire right, title and interest for all countries in and to all inventions and improvements disclosed in the aforesaid application, and in and to the said application, all divisions, continuations, continuations-in-part, or renewals thereof, all Letters Patent which may be granted there from, and all reissues or extensions of such patents, and in and to any and all applications which have been or shall be filed in any foreign countries for Letters Patent on the said inventions and improvements, including an assignment of all rights under the provisions of the International Convention, and all Letters Patent of foreign countries which may be granted there from; and I do hereby authorize and request the Commissioner of Patents and Trademarks to issue any and all United States Letters Patent for the aforesaid inventions and improvements to the said Assignee as the assignee of the entire right, title and interest in and to the same, for the use of the said Assignee, its successors and assigns.

AND, for the consideration aforesaid, I do hereby agree that I and my executors

and legal representatives will make, execute and deliver any and all other instruments in writing including any and all further application papers, affidavits, assignments and other documents, and will communicate to said Assignee, its successors and representatives all facts known to me relating to said improvements and the history thereof and will testify in all legal proceedings and generally do all things which may be necessary or desirable more effectually to secure to and vest in said Assignee, its successors or assigns the entire right, title and interest in and to the said improvements, inventions, applications, Letters Patent, rights, titles, benefits, privileges and advantages hereby sold, assigned and conveyed, or intended so to be.

AND, furthermore, I covenant and agree with said Assignee, its successors and assigns, that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by me and that full right to convey the same as herein expressed is possessed by me.

Legal name of inventor: Siva G. Narendra

Signature:  Date: June 23, 2015

United States Patent Application

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD

As a below named inventor, I hereby declare that:

This declaration is directed to the attached application.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the application, including the claims.

I am aware of the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WHEREAS, I,

Thomas N. Spitzer residing at 2642 SW Bucharest Ct., Portland OR US

made certain new and useful inventions and improvements for which I filed an application for Letters Patent of the United States as identified above;

AND WHEREAS, Tyfone, Inc, a corporation organized and existing under and by virtue of the laws of the State of Oregon, and having an office and place of business at 5331 SW Macadam Ave., Suite 251, Portland, OR 97239 (hereinafter "Assignee"), is desirous of acquiring the entire right, title and interest in and to said inventions, improvements and application and in and to the Letters Patent to be obtained therefore;

NOW, THEREFORE, to all whom it may concern, be it known that for good and valuable consideration, the receipt and sufficiency whereof is hereby acknowledged, I have sold, assigned, and transferred, and by these presents do sell, assign and transfer unto said Assignee, its successors or assigns, the entire right, title and interest for all countries in and to all inventions and improvements disclosed in the aforesaid application, and in and to the said application, all divisions, continuations, continuations-in-part, or renewals thereof, all Letters Patent which may be granted there from, and all reissues or extensions of such patents, and in and to any and all applications which have been or shall be filed in any foreign countries for Letters Patent on the said inventions and improvements, including an assignment of all rights under the provisions of the International Convention, and all Letters Patent of foreign countries which may be granted there from; and I do hereby authorize and request the Commissioner of Patents and Trademarks to issue any and all United States Letters Patent for the aforesaid inventions and improvements to the said Assignee as the assignee of the entire right, title and interest in and to the same, for the use of the said Assignee, its successors and assigns.

AND, for the consideration aforesaid, I do hereby agree that I and my executors

and legal representatives will make, execute and deliver any and all other instruments in writing including any and all further application papers, affidavits, assignments and other documents, and will communicate to said Assignee, its successors and representatives all facts known to me relating to said improvements and the history thereof and will testify in all legal proceedings and generally do all things which may be necessary or desirable more effectually to secure to and vest in said Assignee, its successors or assigns the entire right, title and interest in and to the said improvements, inventions, applications, Letters Patent, rights, titles, benefits, privileges and advantages hereby sold, assigned and conveyed, or intended so to be.

AND, furthermore, I covenant and agree with said Assignee, its successors and assigns, that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by me and that full right to convey the same as herein expressed is possessed by me.

Legal name of inventor: Thomas N. Spitzer

Signature: _____ Date: 6/23/15

United States Patent Application

COMBINED DECLARATION AND ASSIGNMENT

Title of Invention: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD

As a below named inventor, I hereby declare that:

This declaration is directed to the attached application.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I have reviewed and understand the contents of the application, including the claims.

I am aware of the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WHEREAS, I,

Prabhakar Tadepalli residing at E24 Chaithanya Smaran, Whitefield Hoskote Road, Bangalore, Kannamangala, IN

made certain new and useful inventions and improvements for which I filed an application for Letters Patent of the United States as identified above;

AND WHEREAS, Tyfone, Inc, a corporation organized and existing under and by virtue of the laws of the State of Oregon, and having an office and place of business at 5331 SW Macadam Ave., Suite 251, Portland, OR 97239 (hereinafter “Assignee"), is desirous of acquiring the entire right, title and interest in and to said inventions, improvements and application and in and to the Letters Patent to be obtained therefore;

NOW, THEREFORE, to all whom it may concern, be it known that for good and valuable consideration, the receipt and sufficiency whereof is hereby acknowledged, I have sold, assigned, and transferred, and by these presents do sell, assign and transfer unto said Assignee, its successors or assigns, the entire right, title and interest for all countries in and to all inventions and improvements disclosed in the aforesaid application, and in and to the said application, all divisions, continuations, continuations-in-part, or renewals thereof, all Letters Patent which may be granted there from, and all reissues or extensions of such patents, and in and to any and all applications which have been or shall be filed in any foreign countries for Letters Patent on the said inventions and improvements, including an assignment of all rights under the provisions of the International Convention, and all Letters Patent of foreign countries which may be granted there from; and I do hereby authorize and request the Commissioner of Patents and Trademarks to issue any and all United States Letters Patent for the aforesaid inventions and improvements to the said Assignee as the assignee of the entire right, title and interest in and to the same, for the use of the said Assignee, its successors and assigns.

AND, for the consideration aforesaid, I do hereby agree that I and my executors and legal representatives will make, execute and deliver any and all other instruments in writing including any and all further application papers, affidavits, assignments and other documents, and will communicate to said Assignee, its successors and representatives all facts known to me relating to said improvements and the history thereof and will testify in all legal proceedings and generally do all things which may be necessary or desirable more effectually to secure to and vest in said Assignee, its successors or assigns the entire right, title and interest in and to the said improvements, inventions, applications, Letters Patent, rights, titles, benefits, privileges and advantages hereby sold, assigned and conveyed, or intended so to be.

AND, furthermore, I covenant and agree with said Assignee, its successors and assigns, that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by me and that full right to convey the same as herein expressed is possessed by me.

Legal name of inventor: Prabhakar Tadepalli

Signature: _____ Date: June 23, 2015

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 14/833,113

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	600
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1600

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/833,113	08/23/2015	2876	1600	115.001US9.4	20	3

CONFIRMATION NO. 5303

FILING RECEIPT

35781
Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

OC000000077276537

Date Mailed: 09/08/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Siva G. Narendra, Portland, OR;
Thomas N. Spitzer, Portland, OR;
Prabhakar Tadepalli, Bangalore, INDIA;

Applicant(s)

Tyfone, Inc., Portland, OR;

Power of Attorney: The patent practitioners associated with Customer Number 35781

Domestic Priority data as claimed by applicant

This application is a CON of 14/747,770 06/23/2015
which is a CON of 14/680,684 04/07/2015 PAT 9092708
which is a CON of 13/592,323 08/22/2012 PAT 9004361
which is a CON of 13/304,663 11/27/2011 PAT 8573494
which is a CON of 13/114,434 05/24/2011 PAT 8091786
which is a CON of 12/941,410 11/08/2010 PAT 7954715
which is a CON of 12/539,369 08/11/2009 PAT 7828214
which is a CON of 11/063,291 02/22/2005 PAT 7581678

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 09/04/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/833,113**

Projected Publication Date: 12/17/2015

Non-Publication Request: No

Early Publication Request: No

Title

MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

Preliminary Class

235

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	5303

35781 7590 09/24/2015

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

NOTIFICATION DATE	DELIVERY MODE
09/24/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

tlippara@gmail.com
dana.lemoine@tyfone.com
eofficeaction@appcoll.com

Office Action Summary	Application No. 14/833,113	Applicant(s) NARENDRA ET AL.	
	Examiner KARL D. FRECH	Art Unit 2887	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *8/23/15* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of

activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP §§ 706.02(l)(1) - 706.02(l)(3) for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/forms/. The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp.

4. Claims 1-20 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 9,092,708. Although the claims at issue are not identical, they are not patentably distinct from each other because the currently claimed limitations can be found within the Patent ‘708 claims.

5. Re current claim 1: Pat ‘708 claim 1 recites “circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card” and “a processor coupled to the circuitry to cause the circuitry to produce a time-varying magnetic field that represents the transaction data".

6. Re current claim 2: Pat '708 claim 2 recites "wherein the wearable device comprises a watch". Pat '708 claim 2 does not recite that a "mobile device is a mobile phone". Official Notice is taken that mobile electronic devices worn about the wrist can be used as a phone. It would have been obvious to a person of ordinary skill in the art at the time of the invention to implement the mobile device of Pat '708 claim 2 as a watch in order to provide a hands free device.

7. Re current claims 3-9: Pat '708 claims 3-9 are elementally identical to the respective current claims. It is noted that the current claims contain the preamble limitation of a "mobile device" whereas the Patent '708 claims contain the preamble limitation of a "wearable device". However, these preamble limitations are not brought to life in the body of the claims and are considered functional preamble equivalents.

8. Re current claim 10,15,16: Pat '708 claim 10 recites "circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card; smartcard circuitry for performing transactions; and a processor coupled to the smartcard circuitry and the circuitry to produce a time-varying magnetic field" Pat '708 claim 10 does not recite "using single transaction account numbers". Official Notice is taken that having discrete account numbers for "single transactions" is old and well known. It would have been obvious to a person of ordinary skill in the art at the time of the invention to use account numbers for single transactions in the currently claimed invention in order to differentiate between multiple transactions for accounting purposes.

9. Re current claim 11: as in Re current claim 2 and for the same reasons, Pat '708 claim 11 fully encompasses current claim 11.

10. Re current claims 12-14: Pat '708 claims 12-14 are elementally identical.

11. Re current claim 17-20: As seen above, Pat '708 claim 10 recites "circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card; smartcard circuitry for performing transactions; and a processor coupled to the smartcard circuitry and the circuitry to produce a time-varying magnetic field" Pat '708 claim 10 does not recite "using single transaction account numbers". Official Notice is taken that having discrete account numbers for "single transactions" is old and well known. It would have been obvious to a person of ordinary skill in the art at the time of the invention to use account numbers for single transactions in the currently claimed invention in order to differentiate between multiple transactions for accounting purposes. As seen Re current claims 2 and 11 above: the currently claimed mobile phone is obvious in view of the patented wearable device.

12. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claim 1 is rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Burkhardt 4,791,283. Burkhardt discloses magnetic field generators 56,58,60,62 disposed on a card to emulate (mimic) prerecorded magnetic stripes (col 6 lines 15-19). Each generator has a separate drive coil for generating magnetic data on each of the field generators (col 6 lines 19-20), i.e. circuitry. There is disclosed a processor 130 (col 8 line 6).

14. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

16. Claims 3-10,12-16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Burkhardt 4,791,283. Burkhardt does not specifically disclose the card is a credit card used for financial transactions. Official Notice is taken that magnetic stripe credit cards, with discrete and individual account numbers for use in financial transactions are old and well known. Burkhardt does disclose in the background the use of financial transaction cards, including credit cards (col 1 lines 10+). It would have been obvious to a person of ordinary skill in the art at the time of the invention to use the card of Burkhardt as a credit card in a financial transaction.

Doing so would allow for the card of Burkhardt to be used in existing infrastructure and methods.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARL D. FRECH whose telephone number is (571)272-2390. The examiner can normally be reached on maxi-flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

***

Notice of References Cited	Application/Control No. 14/833,113	Applicant(s)/Patent Under Reexamination NARENDRA ET AL.	
	Examiner KARL D. FRECH	Art Unit 2887	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-9,092,708 B1	07-2015	Narendra; Siva G.	G06K19/06187	1/1
*	B	US-4,791,283 A	12-1988	Burkhardt; Norman S.	G06K19/07749	235/436
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	Art Unit
	KARL D FRECH	2887

CPC- SEARCHED		
Symbol	Date	Examiner
G06K 7/10732	9/19/15	kdf
G06K 7/10722	9/19/15	kdf
G06K 7/10881	9/19/15	kdf
G06K 7/10693	9/19/15	kdf
G06K 7/0008	9/19/15	kdf
G06K 7/10891	9/19/15	kdf
G06K 7/10851	9/19/15	kdf
G06K 7/14	9/19/15	kdf
G06K 17/0022	9/19/15	kdf
G06K 7/10772	9/19/15	kdf
G07F 19/20	9/19/15	kdf
G06Q 20/1085	9/19/15	kdf

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
235	462.42	9/19/15	kdf
235	462.43	9/19/15	kdf
235	462.44	9/19/15	kdf
235	472.01	9/19/15	kdf
235	472.02	9/19/15	kdf
235	472.03	9/19/15	kdf
235	379	9/19/15	kdf
235	451	9/19/15	kdf

SEARCH NOTES		
Search Notes	Date	Examiner
brs search history attached	9/19/15	kdf

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 5303

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/833,113	08/23/2015	235	2887	115.001US9.4

APPLICANTS

Tyfone, Inc., Portland, OR;

INVENTORS

Siva G. Narendra, Portland, OR;
Thomas N. Spitzer, Portland, OR;
Prabhakar Tadepalli, Bangalore, INDIA;

**** CONTINUING DATA ***************************

This application is a CON of 14/747,770 06/23/2015
which is a CON of 14/680,684 04/07/2015 PAT 9092708
which is a CON of 13/592,323 08/22/2012 PAT 9004361
which is a CON of 13/304,663 11/27/2011 PAT 8573494
which is a CON of 13/114,434 05/24/2011 PAT 8091786
which is a CON of 12/941,410 11/08/2010 PAT 7954715
which is a CON of 12/539,369 08/11/2009 PAT 7828214
which is a CON of 11/063,291 02/22/2005 PAT 7581678

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

09/04/2015

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /KARL D FRECH/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		OR	16	20	3

ADDRESS

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239
UNITED STATES

TITLE

MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

FILING FEE RECEIVED		
1600	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	**Art Unit**
	KARL D FRECH	2887

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/20/2015								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	86890	mimic emulate	USPAT	OR	OFF	2015/09/20 19:28
L2	23294	(mag magnetic) near3 (stripe strip)	USPAT	OR	OFF	2015/09/20 19:28
L3	110	L1 same L2	USPAT	OR	OFF	2015/09/20 19:28
L4	47160	235/???.ccls.	USPAT	OR	OFF	2015/09/20 19:28
L5	83	L3 and L4	USPAT	OR	OFF	2015/09/20 19:28
L6	1	("4791283").PN.	USPAT; USOCR	OR	OFF	2015/09/20 19:42
S1	7	(("9092708") or ("9004361") or ("8573494") or ("8091786") or ("7954715") or ("7828214") or ("7581678")).PN.	USPAT; USOCR	OR	OFF	2015/09/20 15:13
S2	1	("9092708").PN.	USPAT; USOCR	OR	OFF	2015/09/20 15:16
S3	86890	mimic emulate	USPAT	OR	OFF	2015/09/20 15:21
S4	23294	(mag magnetic) near3 (stripe strip)	USPAT	OR	OFF	2015/09/20 15:22
S5	110	S3 same S4	USPAT	OR	OFF	2015/09/20 15:22
S6	47160	235/???.ccls.	USPAT	OR	OFF	2015/09/20 15:22
S7	50409	S5 adn S6	USPAT	OR	OFF	2015/09/20 15:22
S9	1	("9004361").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:04
S10	1	("8573494").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:04
S11	1	("8091786").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:05
S12	1	("7954715").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:05
S13	1	("7828214").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:06
S14	1	("7581678").PN.	USPAT; USOCR	OR	OFF	2015/09/20 16:07
S15	1	(("6016476") or ("2004077372") or ("2005182710") or ("2003048174")).PN.	USPAT; USOCR	OR	OFF	2015/09/20 17:28

9/20/2015 8:04:54 PM

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	14833113
Filing Date	23-Aug-2015
First Named Inventor	Siva Narendra
Attorney Docket Number	115.001US9.4
Title of Invention	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
Tyfone, Inc.	100%

The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)

9092708

as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:
- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.

○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	

Applicant claims the following fee status:

○ Small Entity

○ Micro Entity

◉ Regular Undiscounted

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES

I certify, in accordance with 37 CFR 1.4(d)(4) that I am:

◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application

Registration Number 40062

○ A sole inventor

○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application

○ A joint inventor; all of whom are signing this request

Signature	/Dana B. LeMoine/
Name	Dana B. LeMoine

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	14833113
Filing Date:	23-Aug-2015
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Filer:	Dana B. LeMoine
Attorney Docket Number:	115.001US9.4

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Statutory or Terminal Disclaimer	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 14833113

Filing Date: 23-Aug-2015

Applicant/Patent under Reexamination: Narendra et al.

Electronic Terminal Disclaimer filed on September 24, 2015

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	23588247
Application Number:	14833113
International Application Number:	
Confirmation Number:	5303
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Customer Number:	35781
Filer:	Dana B. LeMoine
Filer Authorized By:	
Attorney Docket Number:	115.001US9.4
Receipt Date:	24-SEP-2015
Filing Date:	23-AUG-2015
Time Stamp:	13:41:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$160
RAM confirmation Number	11356
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Electronic Terminal Disclaimer-Filed	eTerminal-Disclaimer.pdf	33545 410c54c71c577a3cb557bedd3333ae3a32300580	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30554 176f9406b36aeba3953fbffdddb87dd058943d96	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	64099		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors:	Siva G. Narendra et al.	Examiner: Frech, Karl D.
Serial No.:	14/833,113	Group Art Unit: 2887
Filed:	August 23, 2015	Docket No.: 115.001US9.4
Title:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	

RESPONSE FILED UNDER 37 CFR § 1.111

Filed Via EFS
Commissioner for Patents

Applicant has reviewed the Office Action mailed on September 24, 2015. Please consider the following.

IN THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A mobile ~~device~~ phone comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card; and

a processor coupled to the circuitry to cause the circuitry to produce a time-varying magnetic field that represents a single transaction account number.

2. (Canceled)

3. (Currently Amended) The mobile ~~device~~ phone of claim 1 wherein the time-varying magnetic field mimics a swipe of a magnetic credit card.

4. (Currently Amended) The mobile ~~device~~ phone of claim 1 wherein the single transaction account number represents financial data.

5. (Currently Amended) The mobile ~~device~~ phone of claim 4 wherein the financial data comprises credit card data.

6. (Currently Amended) The mobile ~~device~~ phone of claim 1 further comprising smartcard circuitry coupled to the processor.

7. (Currently Amended) The mobile ~~device~~ phone of claim 1 wherein the single transaction account number represents access data.

8. (Currently Amended) The mobile ~~device~~ phone of claim 1 wherein the time-varying magnetic field mimics a swipe of a magnetic access card.

9. (Currently Amended) The mobile ~~device~~ phone of claim 1 wherein the time-varying magnetic field is used to perform point-of-sale transactions.

10. (Currently Amended) A mobile ~~device~~ phone comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card;

smartcard circuitry for performing transactions using single transaction account numbers; and

a processor coupled to the smartcard circuitry and the circuitry to produce a time-varying magnetic field.

11. (Canceled)

12. (Currently Amended) The mobile ~~device~~ phone of claim 10 wherein the smartcard circuitry is configured to perform point-of-sale transactions.

13. (Currently Amended) The mobile ~~device~~ phone of claim 10 wherein the transactions are financial transactions.

14. (Currently Amended) The mobile ~~device~~ phone of claim 10 wherein the time-varying magnetic field mimics a swipe of a magnetic credit card.

15. (Currently Amended) The mobile ~~device~~ phone of claim 10 wherein the single transaction account numbers have a pre-defined sequence.

16. (Currently Amended) The mobile ~~device~~ phone of claim 10 wherein the single transaction account numbers comprise pre-assigned single-use transaction numbers.

17. (Original) A mobile phone comprising:

circuitry to produce a time-varying magnetic field that mimics a swipe of a magnetic card;

circuitry to enable use of single transaction account numbers; and

a processor coupled to the circuitry to produce a time-varying magnetic field and to the circuitry to enable use of single transaction account numbers, the processor configured to cause a time-varying magnetic field to be produced that represents a single transaction account number.

18. (Original) The mobile phone of claim 17 wherein the circuitry to enable use of single transaction account numbers comprises smartcard circuitry.

19. (Original) The mobile phone of claim 17 wherein the single transaction account numbers have a pre-defined sequence.

20. (Original) The mobile phone of claim 17 wherein the single transaction account numbers comprise pre-assigned single-use transaction numbers.

REMARKS

Applicants have reviewed and considered the Office Action mailed on September 24, 2015. Claims 1, 3-10, and 12-16 are amended, claims 2 and 11 are canceled, and no claims are added; as a result, claims 1, 3-10, and 12-20 are now pending in this application.

Nonstatutory Double Patenting Rejection of the Claims

Claims 1-20 were rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of US Patent No. 9,092,708. A terminal disclaimer is being filed concurrently herewith to overcome this rejection.

Claim Rejections 35 USC § 102

Claim 1 was rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by Burkhardt 4,791,283. Claim 1 has been amended to include the limitations of claim 2. Applicant submits that this rejection has been overcome as a result.

Claim Rejections 35 USC § 103

Claims 3-10, 12-16 were rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Burkhardt 4,791,283. Claim 10 has been amended to include the limitations of claim 11. Applicant submits that the rejection of claim 10 has been overcome as a result. Claims 3-9 depend from claim 1, and claims 12-16 depend from claim 10. These claims are believed to be in condition for allowance at least by virtue of dependency.

The examiner has taken official notice that "having discrete account numbers for 'single transactions' is old and well known" and that "magnetic stripe credit cards, with discrete and individual account numbers for use in financial transactions are old and well known". Applicant traverses the taking of official notice because the facts asserted are not capable of instant and unquestionable demonstration as being well-known and no documentary evidence in support of this official notice has been provided. If this rejection is repeated, applicants respectfully request that documentary evidence or other authority be provided to support the taking of official notice. See MPEP 2144.03.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (971-344-0038) to facilitate prosecution of this application.

Respectfully submitted,

By Applicant's Representative,

Date September 24, 2015 By /Dana B. LeMoine/
Dana B. LeMoine
Reg. No. 40,062

Electronic Acknowledgement Receipt

EFS ID:	23592239
Application Number:	14833113
International Application Number:	
Confirmation Number:	5303
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Customer Number:	35781
Filer:	Dana B. LeMoine/Theresa LeMoine
Filer Authorized By:	Dana B. LeMoine
Attorney Docket Number:	115.001US9.4
Receipt Date:	24-SEP-2015
Filing Date:	23-AUG-2015
Time Stamp:	15:01:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		115_001us9_4_OAR_2015-09-24.pdf	112262 dee3d99777943093aee323c7e03aeccc3256206f	yes	6

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	6
Warnings:			
Information:			
	Total Files Size (in bytes):	112262	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/833,113	Filing Date 08/23/2015	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 09/24/2015

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MONIQUE BRUNSON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

35781 7590 10/28/2015

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

EXAMINER
FRECH, KARL D

ART UNIT	PAPER NUMBER
2887	

DATE MAILED: 10/28/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	5303

TITLE OF INVENTION: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/28/2016

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

35781 7590 10/28/2015

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	5303

TITLE OF INVENTION: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/28/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-451000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

❑ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

❑ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

IPR2025-00644 Page 01534

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	5303

35781 7590 10/28/2015

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

EXAMINER	
FRECH, KARL D	

ART UNIT	PAPER NUMBER
2887	

DATE MAILED: 10/28/2015

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 14/833,113	Applicant(s) NARENDRA ET AL.	
	Examiner KARL D. FRECH	Art Unit 2887	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *9/24/15*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,3-10 and 12-20*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 8/15
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

1. The present application is being examined under the pre-AIA first to invent provisions.

2. Claims 1,3-10,12-20 are allowed.

3. The following is an examiner's statement of reasons for allowance: the terminal disclaimer filed 9/24/15 and the amendment filed 9/24/15 are deemed persuasive.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARL D. FRECH whose telephone number is (571)272-2390. The examiner can normally be reached on maxi-flex.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Paik can be reached on (571) 272-2404. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KARL D FRECH/
Primary Examiner, Art Unit 2887

***

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	**Art Unit**
	KARL D FRECH	2887

CPC						
Symbol					**Type**	**Version**
G06K		19	/	06206	F	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
			/					
			/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	18	
/KARL D FRECH/ Primary Examiner.Art Unit 2887	10/18/15	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	**Art Unit**
	KARL D FRECH	2887

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION	
CLASS	SUBCLASS	CLAIMED	NON-CLAIMED
235	451	G 0 6 K 7 / 08 (2006.01.01)	

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
235	462.42	472.01			

NONE	Total Claims Allowed:	
(Assistant Examiner) (Date)	18	
/KARL D FRECH/ Primary Examiner.Art Unit 2887 10/18/15	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner) (Date)	1	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	**Art Unit**
	KARL D FRECH	2887

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	19												
2	3	18	20												
3	4														
4	5														
5	6														
6	7														
7	8														
8	9														
9	10														
10	12														
11	13														
12	14														
13	15														
14	16														
15	17														
16	18														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 18	
/KARL D FRECH/ Primary Examiner.Art Unit 2887 (Primary Examiner)	10/18/15 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 5

U.S. Patent and Trademark Office

Part of Paper No. 20151018

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	Art Unit
	KARL D FRECH	2887

CPC- SEARCHED		
Symbol	Date	Examiner
G06K 7/10732	9/19/15	kdf
G06K 7/10722	9/19/15	kdf
G06K 7/10881	9/19/15	kdf
G06K 7/10693	9/19/15	kdf
G06K 7/0008	9/19/15	kdf
G06K 7/10891	9/19/15	kdf
G06K 7/10851	9/19/15	kdf
G06K 7/14	9/19/15	kdf
G06K 17/0022	9/19/15	kdf
G06K 7/10772	9/19/15	kdf
G07F 19/20	9/19/15	kdf
G06Q 20/1085	9/19/15	kdf
above search updated	10/18/15	kdf

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
235	462.42	9/19/15	kdf
235	462.43	9/19/15	kdf
235	462.44	9/19/15	kdf
235	472.01	9/19/15	kdf
235	472.02	9/19/15	kdf
235	472.03	9/19/15	kdf
235	379	9/19/15	kdf
235	451	9/19/15	kdf
above search updated		10/18/15	kdf

SEARCH NOTES		
Search Notes	**Date**	**Examiner**
brs search history attached	9/19/15	kdf
brs search updated: history attached	10/18/15	kdf

INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
interference search same as search	history attached	10/18/15	kdf

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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	First Named Inventor	Siva G. Narendra
	Art Unit	
	Examiner Name	
	Attorney Docket Number	115.001US9.4

	124	20080136619	A1	2008-06-12	Moran	
	125	20080147950	A1	2008-06-19	Chen	
	126	20080148077	A1	2008-06-19	Lee et al.	
	127	20080153416	A1	2008-06-26	Washiro	
	128	20080186174	A1	2008-08-07	Alexis et al.	
	129	20080214111	A1	2008-09-04	Moshir et al.	
	130	20080244208	A1	2008-10-02	Narendra et al.	
	131	20080279381	A1	2008-11-13	Narendra et al.	
	132	20080311849	A1	2008-12-18	Washiro	
	133	20080318535	A1	2008-12-25	Black et al.	
	134	20090065571	A1	2009-03-12	Jain	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	135	20090065572	A1	2009-03-12	Jain	
	136	20090069049	A1	2009-03-12	Jain	
	137	20090069050	A1	2009-03-12	Jain et al.	
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	141	20090070691	A1	2009-03-12	Jain	
	142	20090070861	A	2009-03-12	Jain	Entire Document
	143	20090108063	A1	2009-04-30	Jain et al.	
	144	20090150610	A1	2009-06-11	Hsu et al.	
	145	20090152361	A1	2009-06-18	Narendra et al.	

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	146	20090199283	A1	2009-08-06	Jain	
	147	20090250521	A1	2009-10-08	Fujita et al.	
	148	20090265552	A1	2009-10-22	Moshir et al.	
	149	20090270127	A1	2009-10-29	Kakimoto	
	150	20090290582	A1	2009-11-26	Suenaga et al.	
	151	20090298540	A1	2009-12-03	Narendra et al.	
	152	20090315667	A1	2009-12-24	Kawamura et al.	
	153	20100033307	A	2010-02-11	Narendra et al.	Entire Document
	154	20100033310	A	2010-02-11	Narendra et al.	Entire Document
	155	20100049878	A1	2010-02-25	Yu et al.	
	156	20100213265	A1	2010-08-26	Narendra et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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First Named Inventor	Siva G. Narendra
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Examiner Name	
Attorney Docket Number	115.001US9.4

	157	20110000960	A	2011-01-06	Harris	Entire Document
	158	20110053644	A1	2011-03-03	Narendra et al.	
	159	20110073663	A1	2011-03-31	Narendra et al.	
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	161	20110077052	A1	2011-03-31	Narendra et al.	
	162	20110110404	A1	2011-05-12	Washiro	
	163	20110171996	A1	2011-07-14	Narendra et al.	
	164	20110180610	A1	2011-07-28	Narendra et al.	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Siva G. Narendra
	Art Unit	
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	Attorney Docket Number	115.001US9.4

	168	20110271044	A1	2011-11-03	Narendra et al.	
	169	20110272468	A1	2011-11-10	Narendra et al.	
	170	20110272469	A1	2011-11-10	Narendra et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	10054890	DE	A1	2002-04-25	Schneider		☐
	2	3632294	DE	A1	1988-04-07	Limmer		☐
	3	0818757	EP	A2	1998-01-14	Hazra et al.		☐
	4	1014290	EP	A2	2000-06-28	Kettunene et al.		☐
	5	1117068	EP	A1	2001-07-18	Nagaoka et al.		☐
	6	1178450	EP	A2	2002-02-06	Vazvan		☐

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First Named Inventor	Siva G. Narendra
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	7	1189465	EP	A1	2002-03-20	Christensen Per et al.		☐
	8	1291748	EP	A2	2003-03-12	Stevens et al.		☐
	9	161060	EP	A1	1985-11-13	Pullukat Thomas et al.		☐
	10	2316908	GB	A	1998-03-11	Cowling		☐
	11	2000010668	JP	A	2000-01-14	Funatsu		☐
	12	2005018671	JP	A	2005-01-20	Okawa et al.		☐
	13	2007199847	JP	A	2007-08-09	Nakao et al.		☐
	14	2007328689	JP	A	2007-12-20	Yamada		☐
	15	4102112	JP	A	1992-04-03	Fukushima et al.		☐
	16	200905471	TW	A	2009-02-01	Narendra et al.		☐
	17	201020934	TW	A	2010-06-01	Narendra et al.		☐

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Filing Date	
First Named Inventor	Siva G. Narendra
Art Unit	
Examiner Name	
Attorney Docket Number	115.001US9.4

	18	201023662	TW	A	2010-06-16	Narendra et al.		☐
	19	201126422	TW	A	2011-08-01	Narendra et al.	English Abstract	☐
	20	I336449	TW		2011-01-21	Narendra et al.		☐
	21	0014678	WO	A1	2000-03-16	Combaluzier Pierre		☐
	22	0188659	WO	A2	2001-11-22	Wong et al.		☐
	23	03029942	WO	A2	2003-04-10	Burger et al.		☐
	24	03077473	WO	A1	2003-09-18	Andersson et al.		☐
	25	03081519	WO	A2	2003-10-02	Thomas et al.		☐
	26	2004012352	WO	A1	2004-02-05	Goldthwaite et al.		☐
	27	2004095169	WO	A2	2004-11-04	Osterweil et al.		☐
	28	2005027030	WO	A1	2005-03-24	Kurokawa et al.		☐

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	29	2005119607	WO	A2	2005-12-15	Spitzer et al.		☐
	30	2005119608	WO	A1	2005-12-15	Spitzer et al.		☐
	31	2006091709	WO	A2	2006-08-31	Narendra et al.		☐
	32	2006108184	WO	A1	2006-10-12	Narendra et al.		☐
	33	2007011937	WO	A2	2007-01-25	Narendra et al.		☐
	34	2008121566	WO	A1	2008-10-09	Narendra et al.		☐
	35	2009147548	WO	A2	2009-12-10	Corda		☐
	36	2010099093	WO	A1	2010-09-02	Narendra et al.		☐
	37	9626500	WO	A1	1996-08-29	Peek		☐
	38	9812674	WO	A2	1998-03-26	Field John		☐

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	Examiner Name	
	Attorney Docket Number	115.001US9.4

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	International Search Report PCT Application No. PCT/US2005/019988, December 16, 2005, 5 pages.	☐
	2	International Search Report PCT Application No. PCT/US2005/022993, October 21, 2005, 3 pages.	☐
	3	International Search Report PCT Application No. PCT/US2006/013603, January 9, 2006, 3 pages.	☐
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	5	International Search Report PCT Application No. PCT/US2008/057588, August 7, 2008, 1 pages.	☐
	6	International Written Opinion PCT Application No. PCT/US2005/019988 , Dec. 4, 2006, 9 Pages.	☐
	7	International Written Opinion PCT Application No. PCT/US2005/019988, Jan. 11, 2006, 8 pages.	☐
	8	International Written Opinion PCT Application No. PCT/US2005/022993, December 4, 2006, 6 pages.	☐
	9	International Written Opinion PCT Application No. PCT/US2006/006361, August 28, 2007, 8 pages.	☐
	10	International Written Opinion PCT Application No. PCT/US2006/006361, September 22, 2006, 13 pages.	☐

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Examiner Name	
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	11	International Written Opinion PCT Application No. PCT/US2006/013603, October 9, 2007, 7 pages.	☐
	12	International Written Opinion PCT Application No. PCT/US2006/027847, January 22, 2008, 10 pages.	☐
	13	International Written Opinion PCT Application No. PCT/US2008/057588, Aug. 7, 2008, 5 pages.	☐
	14	International Written Opinion PCT Application No. PCT/US2008/057588, October 6, 2009, 6 pages.	☐
	15	International Written Opinion PCT Application No. PCT/US2010/025014, April 15, 2010, 9 pages.	☐
	16	International Written Opinion PCT Application No. PCT/US2010/025014, September 09, 2011, 6 pages.	☐
	17	Lee, Youbok; "Antenna Circuit Design for RFID Applications", Microchip, AN710, 2003 Microchip Technology Inc., (2003), 50 pages.	☐
	18	Official Letter from Taiwan Patent Office (115.001TW1), Application 95105997, mailed on Jan. 26, 2010, 6 pages.	☐
	19	US Patent Application 13/592,323 Office Action dated September 30, 2014, 6 pages	☐
	20	US Patent Application 14/680,684 Office Action dated May 22, 2015, 5 pages.	☐

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	First Named Inventor	Siva G. Narendra
	Art Unit	
	Examiner Name	
	Attorney Docket Number	115.001US9.4

EXAMINER SIGNATURE			
Examiner Signature	/Karl Frech/	Date Considered	10/19/2015

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First Named Inventor	Siva G. Narendra
Art Unit	
Examiner Name	
Attorney Docket Number	115.001US9.4

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Dana B.LeMoine/	Date (YYYY-MM-DD)	2015-08-23
Name/Print	Dana B. LeMoine	Registration Number	40062

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	224941	mimic emulate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/10/18 14:53
L7	77473	(mag magnetic) near3 (strip stripe)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/10/18 14:54
L8	311	6 same 7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/10/18 14:54
L9	105961	235/???.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/10/18 14:54
L10	200	8 and 9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2015/10/18 14:54

10/ 18/ 2015 2:54:44 PM

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	205046	mimic emulate	US-PGPUB; USPAT	OR	OFF	2015/10/18 14:52
L2	49548	(mag magnetic) near3 (stripe strip)	US-PGPUB; USPAT	OR	OFF	2015/10/18 14:52
L3	292	1 same 2	US-PGPUB; USPAT	OR	OFF	2015/10/18 14:52
L4	64042	235/???.ccls.	US-PGPUB; USPAT	OR	OFF	2015/10/18 14:52
L5	194	3 and 4	US-PGPUB; USPAT	OR	OFF	2015/10/18 14:52

10/18/2015 2:53:20 PM

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14833113	NARENDRA ET AL.
	Examiner	**Art Unit**
	KARL D FRECH	2887

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	09/20/2015	10/18/2015							
1	1	✓	=							
	2	✓	-							
2	3	✓	=							
3	4	✓	=							
4	5	✓	=							
5	6	✓	=							
6	7	✓	=							
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8	9	✓	=							
9	10	✓	=							
	11	✓	-							
10	12	✓	=							
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12	14	✓	=							
13	15	✓	=							
14	16	✓	=							
15	17	✓	=							
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	5303

TITLE OF INVENTION: MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	01/28/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
FRECH, KARL D	2887	235-451000

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2
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☐ A check is enclosed.
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☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29
NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Dana B. LeMoine/ Date October 28, 2015

Typed or printed name Dana B. LeMoine Registration No. 40,062

IPR2025-00644 Page 01582

Electronic Patent Application Fee Transmittal

Application Number:	14833113
Filing Date:	23-Aug-2015
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Filer:	Dana B. LeMoine/Theresa LeMoine
Attorney Docket Number:	115.001US9.4

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**960**

Electronic Acknowledgement Receipt

EFS ID:	23912317
Application Number:	14833113
International Application Number:	
Confirmation Number:	5303
Title of Invention:	MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS
First Named Inventor/Applicant Name:	Siva G. Narendra
Customer Number:	35781
Filer:	Dana B. LeMoine/Theresa LeMoine
Filer Authorized By:	Dana B. LeMoine
Attorney Docket Number:	115.001US9.4
Receipt Date:	28-OCT-2015
Filing Date:	23-AUG-2015
Time Stamp:	11:27:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	13042
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	14833113_PTOL85B_10-28-2015.pdf	90978 fdf11c41858ac38d3a888339f6ca04c1b15a723b	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30691 d340f521df94097245a41c2967dac51f294bf535	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	121669		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/833,113	12/08/2015	9208423	115.001US9.4	5303

35781 7590 11/18/2015

Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Siva G. Narendra, Portland, OR;
Tyfone, Inc., Portland, OR;
Thomas N. Spitzer, Portland, OR;
Prabhakar Tadepalli, Bangalore, INDIA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4

CONFIRMATION NO. 5303

PUBLICATION NOTICE

35781
Tyfone, Inc.
Patent Dept.
5331 SW Macadam Avenue
Suite 251
Portland, OR 97239

OC00000079442973

Title:MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS

Publication No.US-2015-0363684-A1
Publication Date:12/17/2015

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6233870

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	RELEASE OF SECURITY INTEREST

CONVEYING PARTY DATA

Name	Execution Date
RPX CORPORATION	07/27/2020

RECEIVING PARTY DATA

Name:	TYFONE, INC.
Street Address:	5331 SW MACADAM AVENUE
City:	PORTLAND
State/Country:	OREGON
Postal Code:	97239

PROPERTY NUMBERS Total: 109

Property Type	Number
Patent Number:	7581678
Patent Number:	7828214
Patent Number:	7954715
Patent Number:	7954716
Patent Number:	8091786
Patent Number:	8573494
Patent Number:	8408463
Patent Number:	8403219
Patent Number:	7954717
Patent Number:	8083145
Patent Number:	8474718
Patent Number:	8136732
Patent Number:	9004361
Patent Number:	9092708
Patent Number:	9202156
Patent Number:	9208423
Patent Number:	9251453
Patent Number:	9626611
Patent Number:	9715649
Patent Number:	10185909

Property Type	Number
Patent Number:	7805615
Patent Number:	8477940
Patent Number:	8189788
Patent Number:	7364092
Patent Number:	7991158
Application Number:	13104962
Patent Number:	9741027
Patent Number:	7961101
Patent Number:	8072331
Patent Number:	8410936
Patent Number:	8814053
Application Number:	12188382
Patent Number:	8231061
Patent Number:	8745709
Patent Number:	9055029
Patent Number:	9148405
Application Number:	14850297
Patent Number:	8451122
Patent Number:	8866614
Patent Number:	8937549
Patent Number:	9122965
Patent Number:	9117152
Patent Number:	9483722
Patent Number:	9489608
Patent Number:	9390359
Patent Number:	9904887
Patent Number:	8843062
Application Number:	14464888
Application Number:	13295902
Patent Number:	8949974
Application Number:	13591210
Patent Number:	9087184
Application Number:	13470163
Application Number:	13531342
Application Number:	14289884
Application Number:	13630342
Patent Number:	9077794
Patent Number:	9166281

Property Type	Number
Patent Number:	9281633
Patent Number:	9520684
Patent Number:	9195974
PCT Number:	US1423514
Application Number:	13802492
Patent Number:	9177310
Application Number:	13802510
Patent Number:	9230282
Patent Number:	9959532
Patent Number:	9959533
Patent Number:	9959534
Application Number:	13802523
Application Number:	13842871
Patent Number:	9143938
Patent Number:	9215592
Patent Number:	9319881
Patent Number:	9906365
PCT Number:	US1423533
Patent Number:	9781598
Application Number:	13843628
Patent Number:	9231945
Patent Number:	9436165
Patent Number:	9563892
Patent Number:	9659295
Patent Number:	9448543
Patent Number:	9576281
Patent Number:	9183371
Patent Number:	9154500
Application Number:	13844216
Application Number:	13844255
Application Number:	13844301
Application Number:	13844339
Application Number:	14741493
Application Number:	13842937
Application Number:	13843065
Patent Number:	9207650
Patent Number:	9113329
Application Number:	14047023

Property Type	Number
Application Number:	14047024
Patent Number:	9483723
Patent Number:	9715650
Patent Number:	9208424
Patent Number:	9159014
Application Number:	14105776
Application Number:	14244845
Patent Number:	9317723
Patent Number:	9373010
Patent Number:	9317796
Patent Number:	9495628
Application Number:	15290672
Application Number:	14044636

CORRESPONDENCE DATA

Fax Number: (503)972-3873

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 503-221-1440
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ATTORNEY DOCKET NUMBER:	38636-00015
NAME OF SUBMITTER:	CHRISTOPHER D. ERICKSON
SIGNATURE:	/Christopher D. Erickson/
DATE SIGNED:	08/04/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 5
source=Tyfone Form Release of Security Interest from RPX (for Tyfone) FINAL 20200727 (DA Sig)#page1.tif
source=Tyfone Form Release of Security Interest from RPX (for Tyfone) FINAL 20200727 (DA Sig)#page2.tif
source=Tyfone Form Release of Security Interest from RPX (for Tyfone) FINAL 20200727 (DA Sig)#page3.tif
source=Tyfone Form Release of Security Interest from RPX (for Tyfone) FINAL 20200727 (DA Sig)#page4.tif
source=Tyfone Form Release of Security Interest from RPX (for Tyfone) FINAL 20200727 (DA Sig)#page5.tif

RELEASE OF SECURITY INTEREST (TERMINATION STATEMENT)

This Release of Security Interest (this "Release"), dated and effective as of July 27, 2020 (the "Effective Date"), is made by RPX Corporation ("Lender") in favor of Tyfone, Inc. ("Borrower").

RECITALS

A. Pursuant to the Loan and Security Agreement dated May 15, 2015 (the "Loan and Security Agreement"), Borrower granted to Lender a security interest in the Patent Collateral (as defined in the Loan and Security Agreement).

B. Subsequent to the effective date of the Loan and Security Agreement, Lender recorded the Loan and Security Agreement with the United States Patent and Trademark Office ("USPTO") and with the State of Oregon, evidencing its security interest in the Patent Collateral, including but not limited to those patents and patent applications listed on Exhibit 1 to this Release.

C. Lender did not record the Loan and Security Agreement with any other authority of office other than ones mentioned in Recital B.

D. Borrower has fully paid the Obligations that were secured by the security interest in the Patent Collateral under the Loan and Security Agreement, and Lender desires to release fully its security interests in the Patent Collateral pursuant to this Release.

TERMS AND CONDITIONS

In consideration of the mutual promises and undertakings set forth herein and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and with the intention of being legally bound hereby, Lender hereby: (a) releases the security interest in the Patent Collateral; and (b) authorizes the recordation of this Release with the USPTO, the State of Oregon, and any other authority or office as may be necessary to effectuate this Release.

Lender agrees to cooperate with Borrower and to execute, acknowledge and deliver such further releases, termination statements, assignments and other assurances pursuant to this Release, as may be reasonably requested by Borrower in order to effectuate the complete release of Lender's security interest in the Patent Collateral.

IN WITNESS WHEREOF, Lender has executed this Release as of the Effective Date:

RPX Corporation

By: David Anderson

Name: David Anderson

Title: CFO

EXHIBIT 1

Title	App. No.	Pub. No.	Pat. No.	Issue Date
ELECTRONIC TRANSACTION CARD	11/063,291	20060186209	7581678	9/1/2009
MOBILE PHONE WITH ELECTRONIC TRANSACTION CARD	12/539,369	20090298540	7828214	11/9/2010
MOBILE DEVICE WITH TRANSACTION CARD IN ADD-ON SLOT	12/941,410	20110053644	7954715	6/7/2011
ELECTRONIC TRANSACTION CARD POWERED BY MOBILE DEVICE	12/962,937	20110073665	7954716	6/7/2011
ADD-ON CARD WITH SMARTCARD CIRCUITRY POWERED BY A MOBILE DEVICE	13/114,434	20110220726	8091786	1/10/2012
APPARATUS FOR SECURE FINANCIAL TRANSACTIONS	13/304,663	20120067964	8573494	11/5/2013
MOBILE DEVICE ADD-ON APPARATUS FOR FINANCIAL TRANSACTIONS	13/370,291	20120138675	8408463	4/2/2013
APPARATUS WITH SMARTCARD CIRCUITRY POWERED BY A MOBILE DEVICE	13/651,365	20130037611	8403219	3/26/2013
PROVISIONING ELECTRONIC TRANSACTION CARD IN MOBILE DEVICE	12/962,953	20110077052	7954717	6/7/2011
PROVISIONING AN ADD-ON APPARATUS WITH SMARTCARD CIRCUITY FOR ENABLING TRANSACTIONS	13/114,473	20110223972	8083145	12/27/2011
METHOD FOR PROVISIONING AN APPARATUS CONNECTED CONTACTLESS TO A MOBILE DEVICE	13/426,500	20120178433	8474718	7/2/2013
ELECTRONIC TRANSACTION CARD WITH CONTACTLESS INTERFACE	13/184,240	20110272469	8136732	3/20/2012
WEARABLE DEVICE TRANSACTION SYSTEM	13/592,323	20130168453	9004361	4/14/2015
WEARABLE DEVICE WITH TIME-VARYING MAGNETIC FIELD	14/680,684	20150213350	9092708	7/28/2015
MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD	14/747,770	20150294208	9202156	12/1/2015
MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	14/833,113	20150363684	9208423	12/8/2015
WEARABLE DEVICE WITH TIME-VARYING MAGNETIC FIELD AND SINGLE TRANSACTION ACCOUNT NUMBERS	14/866,998	20160019450	9251453	2/2/2016
PROVISIONING MOBILE DEVICE WITH TIME-VARYING MAGNETIC FIELD	14/929,297	20160055405	9626611	4/18/2017
DEVICE WITH CURRENT CARRYING CONDUCTOR TO PRODUCE TIME-VARYING MAGNETIC FIELD	14/948,325	20160086073	9715649	7/25/2017
WEARABLE DEVICE WITH CURRENT CARRYING CONDUCTOR TO PRODUCE TIME-VARYING MAGNETIC FIELD	15/658,208	20170323188	10185909	1/22/2019
ASYMMETRIC CRYPTOGRAPHY WITH USER AUTHENTICATION	11/182,520	20070016798	7805615	9/28/2010
SYMMETRIC CRYPTOGRAPHY WITH USER AUTHENTICATION	11/182,099	20070014407	8477940	7/2/2013
HYBRID SYMMETRIC/ASYMMETRIC CRYPTOGRAPHY WITH USER AUTHENTICATION	11/182,920	20070014408	8189788	5/29/2012
ELECTRONIC STRIPE CARDS	11/488,400	20070023532	7364092	4/29/2008
SECURE MESSAGING	11/895,637	20080279381	7991158	8/2/2011
MEMORY CARD HAVING ONE OR MORE SECURE ELEMENTS ACCESSED WITH HIDDEN COMMANDS	13/104,962	20110271044		
MEMORY CARD BASED CONTACTLESS DEVICES	12/002,317	20090152361	9741027	8/22/2017
SMALL RFID CARD WITH INTEGRATED INDUCTIVE ELEMENT	12/188,346	20100033307	7961101	6/14/2011
MOBILE PAYMENT DEVICE	13/081,775	20110180610	8072331	12/6/2011
CONTACTLESS CARD THAT RECEIVES POWER FROM HOST DEVICE	13/311,247	20120305653	8410936	4/2/2013

Title	App. No.	Pub. No.	Pat. No.	Issue Date
MOBILE PAYMENT DEVICE WITH SMALL INDUCTIVE DEVICE POWERED BY A HOST DEVICE	13/657,846	20130043317	8814053	8/26/2014
POWER NEGOTATION FOR SMALL RFID CARD	12/188,382	20100033310		
CONTACTLESS DEVICE WITH MINIATURIZED ANTENNA	12/710,560	20100213265	8231061	7/31/2012
MULTIFACTOR AUTHENTICATION SERVICE	13/036,774	20120222099	8745709	6/3/2014
TOKEN BASED MULTIFACTOR AUTHENTICATION	14/289,901	20140282859	9055029	6/9/2015
CLIENT DEVICE TOKEN BASED MULTIFACTOR AUTHENTICATION	14/608,073	20150143457	9148405	9/29/2015
SMARTCARD BASED MULTIFACTOR BANKING AUTHENTICATION	14/850,297	20150381613		
SMARTCARD PERFORMANCE ENHANCEMENT CIRCUITS AND SYSTEMS	13/038,341	20110171996	8451122	5/28/2013
ACTIVE CIRCUIT FOR RFID	13/871,849	20130233931	8866614	10/21/2014
ENHANCED INTEGRATED CIRCUIT WITH SMARTCARD CONTROLLER	14/460,647	20140353390	8937549	1/20/2015
13.56 MHZ ENHANCEMENT CIRCUIT FOR SMARTCARD CONTROLLER	14/517,495	20150034727	9122965	9/1/2015
13.56 MHZ ENHANCEMENT CIRCUIT FOR SMARTMX SMARTCARD CONTROLLER	14/517,567	20150034728	9117152	8/25/2015
AMPLIFIER AND TRANSMISSION SOLUTION FOR 13.56MHZ RADIO COUPLED TO SMARTCARD CONTROLLER	14/517,575	20150038194	9483722	11/1/2016
AMPLIFIER AND TRANSMISSION SOLUTION FOR 13.56MHZ RADIO COUPLED TO SMARTMX SMARTCARD CONTROLLER	14/517,585	20150038195	9489608	11/8/2016
MOBILE DEVICE WITH A CONTACTLESS SMARTCARD DEVICE AND ACTIVE LOAD MODULATION	14/542,440	20150069139	9390359	7/12/2016
COMPUTING DEVICE WITH NFC AND ACTIVE LOAD MODULATION	15/338,436	20170046609	9904887	2/27/2018
COUPLING AREA ENHANCEMENT APPARATUS, SYSTEM, AND METHOD	13/097,167	20120276963	8843062	9/23/2014
MOBILE DEVICE WITH COUPLING AREA ENHANCEMENT	14/464,888	20140354503		
MOBILE DEVICE POWER MANAGEMENT	13/295,902	20130122804		
MOBILE DEVICE WITH PASSWORD PROTECTED DESKTOP SCREEN	13/470,139	20130305351	8949974	2/3/2015
APPLICATION WITH DEVICE SPECIFIC USER INTERFACE	13/591,210	20130303084		
MOBILE DEVICE WITH DESKTOP SCREEN INDICATORS	13/591,213	20130305352	9087184	7/21/2015
INSTALLING APPLICATIONS TO PASSWORD PROTECTED DESKTOP SCREENS ON A MOBILE DEVICE	13/470,163	20130305240		
METHOD AND APPARATUS FOR SECURE CONSOLIDATION OF CLOUD SERVICES	13/531,342	20130347075		
SECURE ELEMENT APPARATUS WITH MEMORY	14/289,884	20140273970		
MOBILE DEVICE WITH REVEAL OF DYNAMIC CONTENT	13/630,342	20140095315		
LIGHTNING CONNECTOR ACCESSORY DEVICE	13/629,595	20140087789	9077794	7/7/2015
OFFSET PCB LIGHTNING CONNECTOR ACCESSORY DEVICE	14/729,268	20150270601	9166281	10/20/2015
MICROUSB ACCESSORY DEVICE WITH ANTENNA	14/843,336	20150380874	9281633	3/8/2016
MICROUSB LIGHTNING DEVICE WITH OFFSET CIRCUIT BOARD	15/053,806	20160181737	9520684	12/13/2016
DYNAMIC IDENTITY REPRESENTATION IN MOBILE DEVICES	14/044,636	20150095222		
REMOTE DEPOSIT CAPTURE COMPATIBLE CHECK IMAGE GENERATION	13/802,481	20140270461	9195974	11/24/2015
MOBILE REMOTE DEPOSIT CAPTURE	PCT/US14/23514	WO 2014/159412		
REMOTE DEPOSIT CAPTURE COMPATIBLE CHECK IMAGE GENERATION IN RESPONSE TO MOTION OF A MOBILE DEVICE	13/802,492	20140279480		
MOBILE DEVICE AND APPLICATION FOR REMOTE DEPOSIT OF CHECK IMAGES RECEIVED FROM PAYORS	13/802,498	20140270462	9177310	11/3/2015

Title	App. No.	Pub. No.	Pat. No.	Issue Date
MOBILE DEVICE AND APPLICATION FOR REMOTE DEPOSIT OF CHECK IMAGES SECURELY RECEIVED FROM PAYORS	13/802,510	20140279481		
REMOTE DEPOSIT CAPTURE SYSTEM WITH CHECK IMAGE GENERATION AND STORAGE	13/802,516	20140270463	9230282	1/5/2016
SECURE ELEMENT AUTHENTICATION FOR REMOTE DEPOSIT CAPTURE COMPATIBLE CHECK IMAGE GENERATION	14/979,974	20160110697	9959532	5/1/2018
SECURE ELEMENT AUTHENTICATION FOR REMOTE DEPOSIT OF CHECK IMAGES RECEIVED FROM PAYORS	14/982,904	20160117648	9959533	5/1/2018
REMOTE DEPOSIT CAPTURE SYSTEM WITH SECURE ELEMENT AUTHENTICATION FOR CHECK IMAGE GENERATION AND STORAGE	14/983,166	20160132848	9959534	5/1/2018
REMOTE DEPOSIT CAPTURE SYSTEM WITH CHECK IMAGE STORAGE	13/802,523	20140279482		
PERSONAL DIGITAL IDENTITY DEVICE	13/842,871	20140273959		
PERSONAL DIGITAL IDENTITY DEVICE RESPONSIVE TO USER INTERACTION	13/843,000	20140270173	9143938	9/22/2015
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE RESPONSIVE TO USER INTERACTION	13/843,091	20140281565	9215592	12/15/2015
PERSONAL DIGITAL IDENTITY DEVICE WITH FINGERPRINT SENSOR	13/843,402	20140273961	9319881	4/19/2016
PERSONAL DIGITAL IDENTITY DEVICE WITH FINGERPRINT SENSOR AND CHALLENGE-RESPONSE KEY	15/069,548	20160197727	9906365	2/27/2018
PERSONAL DIGITAL IDENTITY DEVICE	PCT/US14/23533	WO 2014/150535		
PERSONAL DIGITAL IDENTITY DEVICE WITH FINGERPRINT SENSOR RESPONSIVE TO USER INTERACTION	13/843,529	20140266601	9781598	10/3/2017
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE WITH FINGERPRINT SENSOR RESPONSIVE TO USER INTERACTION	13/843,628	20140266602		
PERSONAL DIGITAL IDENTITY DEVICE WITH MOTION SENSOR	13/843,694	20140281566	9231945	1/5/2016
PERSONAL DIGITAL IDENTITY DEVICE WITH MOTION SENSOR RESPONSIVE TO USER INTERACTION	13/843,831	20140266597	9436165	9/6/2016
PERSONAL DIGITAL IDENTITY CARD WITH MOTION SENSOR RESPONSIVE TO USER INTERACTION	15/237,624	20160358166	9563892	2/7/2017
PERSONAL DIGITAL IDENTITY DEVICE WITH NEAR FIELD AND NON NEAR FIELD RADIOS FOR ACCESS CONTROL	15/249,081	20160366591	9659295	5/23/2017
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE WITH MOTION SENSOR RESPONSIVE TO USER INTERACTION	13/843,988	20140266598	9448543	9/20/2016
CONFIGURABLE PERSONAL DIGITAL IDENTITY CARD WITH MOTION SENSOR RESPONSIVE TO USER INTERACTION	15/237,735	20160358148	9576281	2/21/2017
PERSONAL DIGITAL IDENTITY DEVICE WITH MICROPHONE	13/844,141	20140282987	9183371	11/10/2015
PERSONAL DIGITAL IDENTITY DEVICE WITH MICROPHONE RESPONSIVE TO USER INTERACTION	13/844,183	20140266605	9154500	10/6/2015
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE WITH MICROPHONE RESPONSIVE TO USER INTERACTION	13/844,216	20140266606		
PERSONAL DIGITAL IDENTITY DEVICE WITH IMAGER	13/844,255	20140270175		
PERSONAL DIGITAL IDENTITY DEVICE WITH IMAGER RESPONSIVE TO USER INTERACTION	13/844,301	20140266603		
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE WITH IMAGER RESPONSIVE TO USER INTERACTION	13/844,339	20140266599	9086689	7/21/2015
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE WITH AUTHENTICATION USING IMAGE RECEIVED OVER RADIO LINK	14/741,493	20150317468	9734319	8/15/2017
PERSONAL DIGITAL IDENTITY DEVICE WITH USER AUTHENTICATION FACTOR CAPTURED IN MOBILE DEVICE	13/842,937	20140273960		
PERSONAL DIGITAL IDENTITY DEVICE RESPONSIVE TO USER INTERACTION WITH USER AUTHENTICATION FACTOR CAPTURED IN MOBILE DEVICE	13/843,065	20140270174		

Title	App. No.	Pub. No.	Pat. No.	Issue Date
CONFIGURABLE PERSONAL DIGITAL IDENTITY DEVICE RESPONSIVE TO USER INTERACTION WITH USER AUTHENTICATION FACTOR CAPTURED IN MOBILE DEVICE	13/843,181	20140266596	9207650	12/8/2015
MOBILE DEVICE LEARNING MODE FOR SECURE IDENTIFICATION	14/083,208	20150140966	9113329	8/18/2015
LIGHT SEQUENCE OUT-OF-BAND BLUETOOTH PAIRING	14/047,023	20150098706		
AUDIO SEQUENCE OUT-OF-BAND BLUETOOTH PAIRING	14/047,024	20150099466		
PASSIVE CONTROL SECURE TRANSACTION CARD	14/047,005	20150097037	9483723	11/1/2016
DUAL COIL TRANSACTION CARD	15/337,675	20170046608	9715650	7/25/2017
ACTIVE CONTROL SECURE TRANSACTION CARD	14/047,006	20150097038	9208424	12/8/2015
ACTIVE CONTROL SECURE TRANSACTION CARD WITH TUNED COIL	14/047,007	20150097039	9159014	10/13/2015
URL MAPPING TO NON-HYPERLINKED CODE	14/105,776	20150172368		
PASSIVE RF TAG WITH MULTIPLE CONDUCTIVE COILS	14/244,845	20150286847		
PASSIVE RF TAG WITH POWER CYCLING	14/244,852	20150286848	9317723	4/19/2016
PASSIVE RFID TAG COIL ALIGNMENT AND COMMUNICATION	15/075,486	20160203348	9373010	6/21/2016
RF PROBE ALIGNMENT WITH PASSIVE TAG	14/244,853	20150286850	9317796	4/19/2016
PASSIVE RF TAG WITH ADIABATIC CIRCUITS	14/244,855	20150286918	9495628	11/15/2016
FINE GRAIN RECONFIGURABLE BUILDING BLOCK FOR IC PROTECTION AND OBFUSCATION	15/290,672	20180102908		

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
14/833,113	08/23/2015	Siva G. Narendra	115.001US9.4	187507

Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 04/13/2023 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant asserting small entity status. See 37 CFR 1.27.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Usman Mughal/
Name:	Usman Mughal
Registration Number:	62887