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(54) WIRELESS IDENTIFICATION DEVICE, RFID DEVICE, AND METHOD OF MANUFACTURING WIRELESS IDENTIFICATION DEVICE

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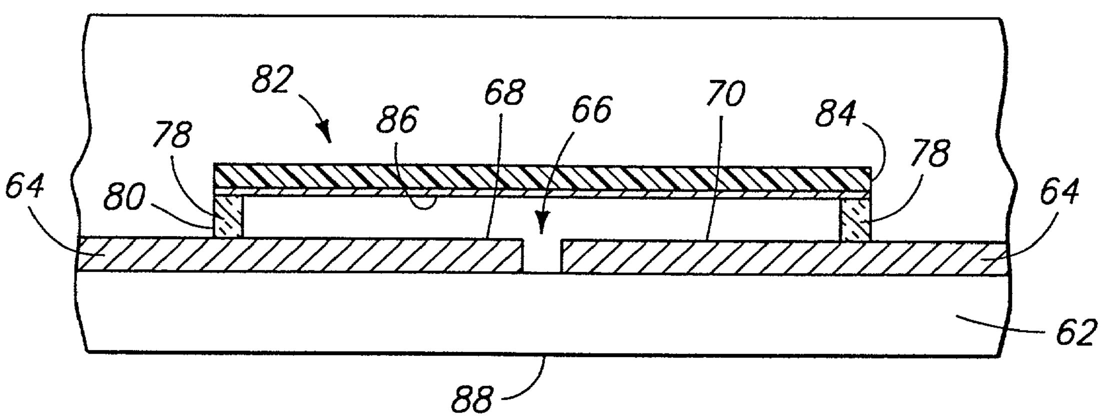
(57) **ABSTRACT**

A wireless identification device comprising a housing; circuitry in the housing configured to provide a signal to identify the device in response to an interrogation signal; and a selectively actuated switch supported by the housing and permitting operation of the circuitry only while the switch is actuated. A method of manufacturing a wireless identification device, the method comprising configuring circuitry to provide a signal to identify the device in response to an interrogation signal; coupling the circuitry to a selectively actuated switch, such that the circuitry provides the signal only while the switch is actuated; and encasing the circuitry in a housing such that the switch is actuable from outside the housing by touching a portion of the housing.



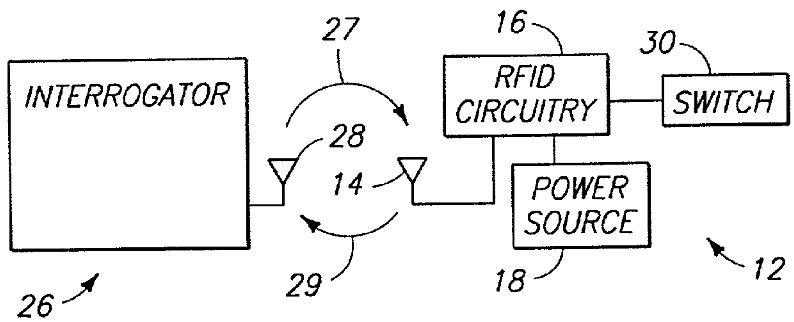


FIG. 1

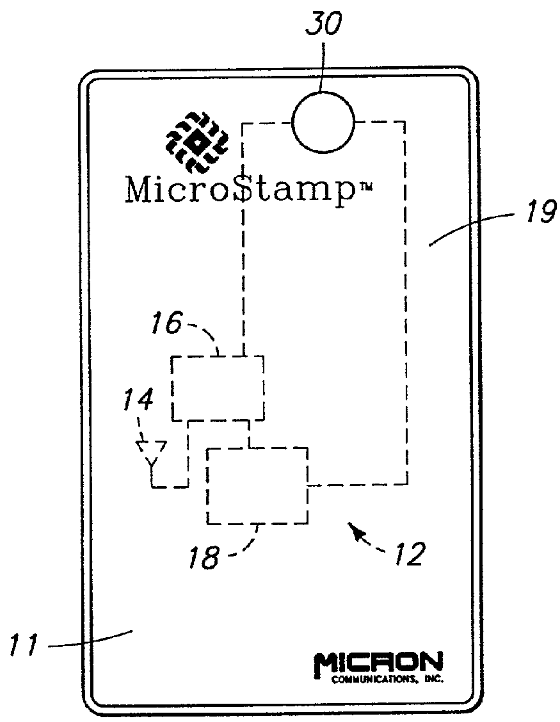


FIG. 2

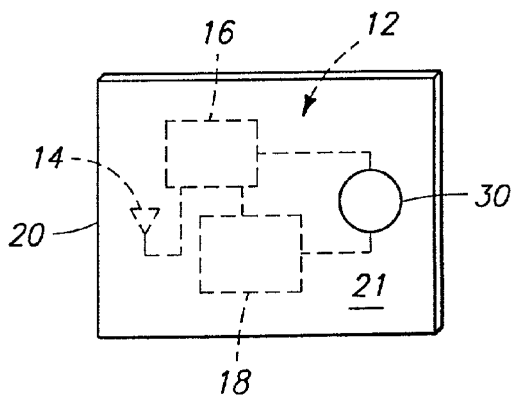
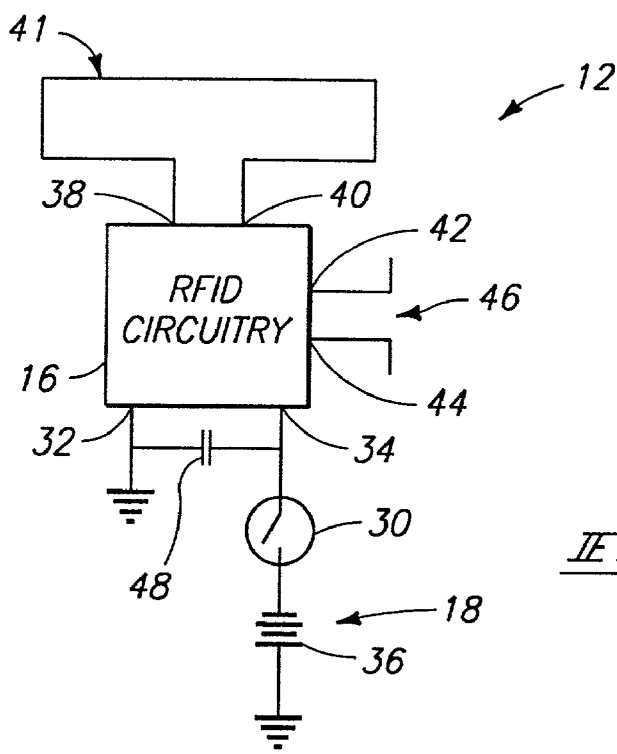


FIG. 3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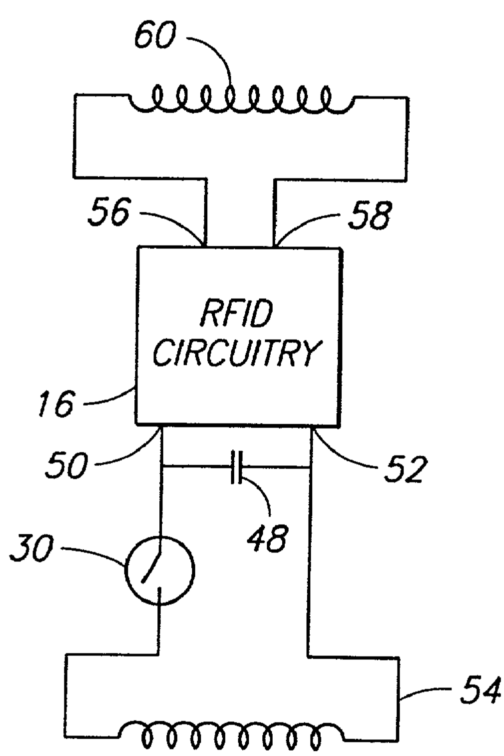
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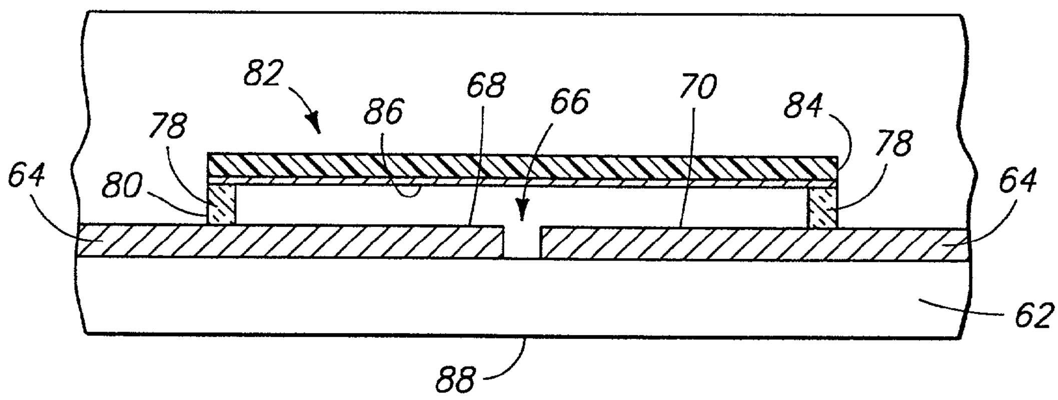

Fig 6

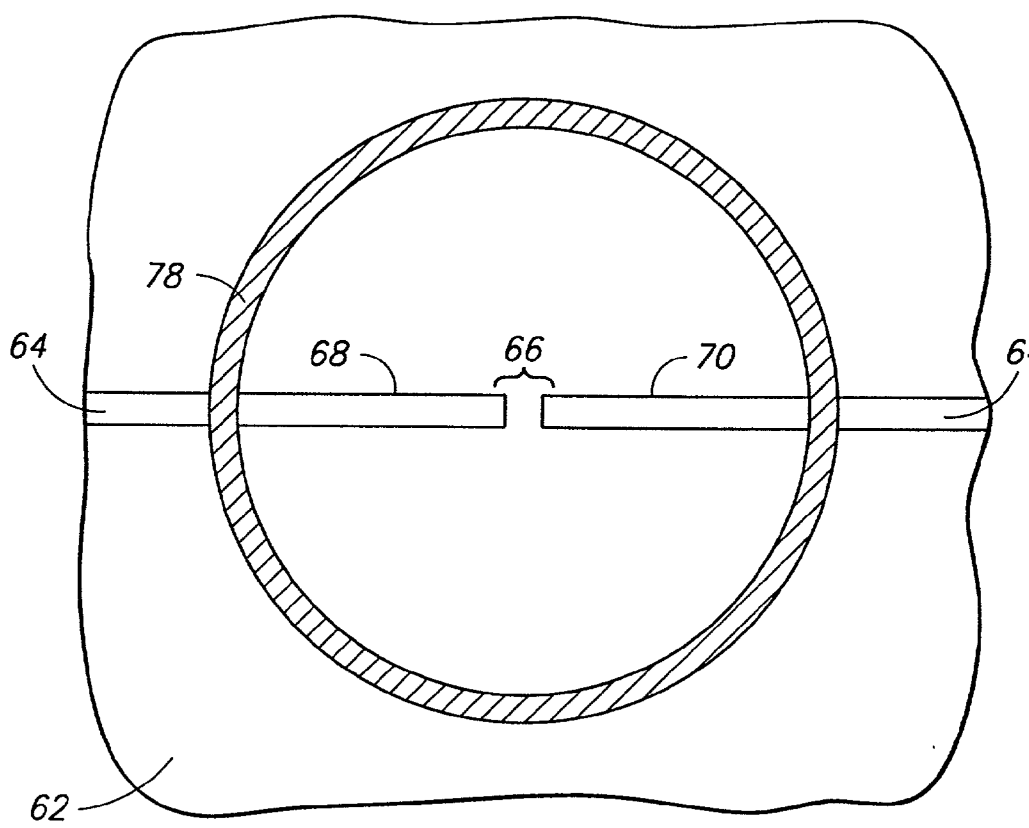

Fig 7

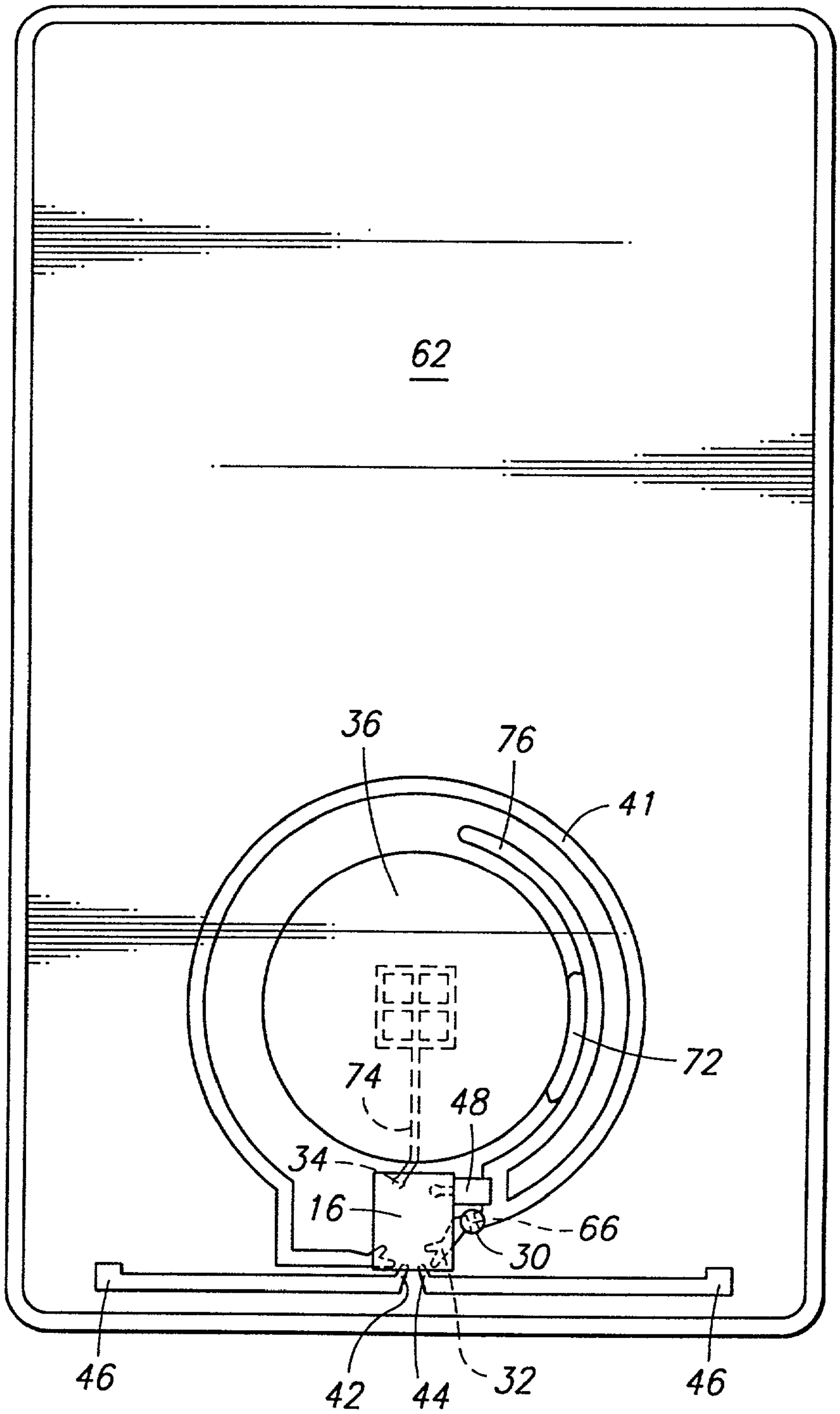

Fig 8

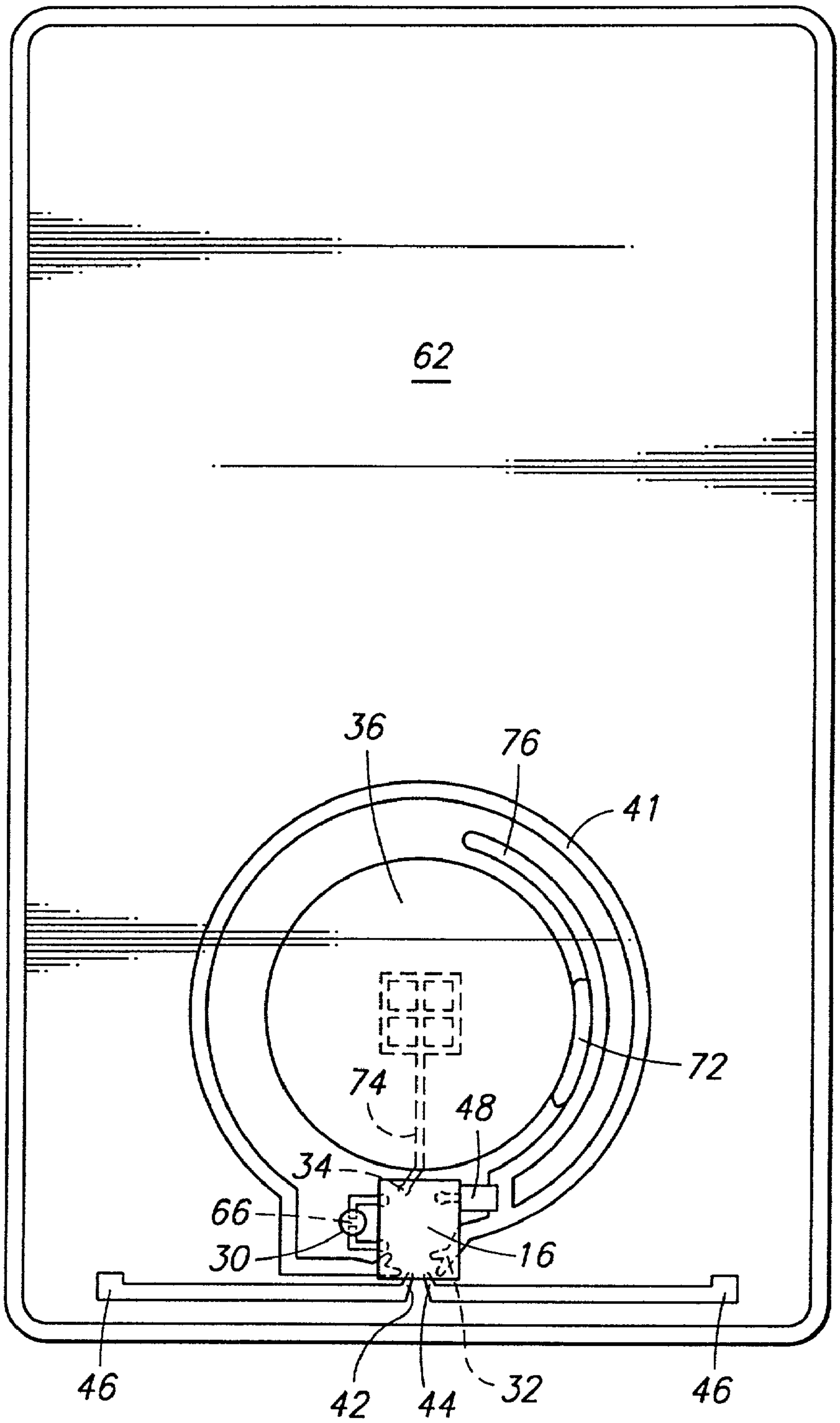

Fig 9

WIRELESS IDENTIFICATION DEVICE, RFID DEVICE, AND METHOD OF MANUFACTURING WIRELESS IDENTIFICATION DEVICE

TECHNICAL FIELD

[0001] This invention relates to radio frequency communication devices. More particularly, the invention relates to radio frequency identification devices for inventory control, object monitoring, determining the existence, location or movement of objects, or for remote automated payment.

BACKGROUND OF THE INVENTION

[0002] As large numbers of objects are moved in inventory, product manufacturing, and merchandising operations, there is a continuous challenge to accurately monitor the location and flow of objects. Additionally, there is a continuing goal to interrogate the location of objects in an inexpensive and streamlined manner. One way of tracking objects is with an electronic identification system.

[0003] One presently available electronic identification system utilizes a magnetic coupling system. In some cases, the tag device may be provided with a unique identification code in order to distinguish between a number of different tags. Typically, the tag devices are entirely passive (have no power supply), which results in a small and portable package. However, this identification system is only capable of operation over a relatively short range, limited by the size of a magnetic field used to supply power to the tags and to communicate with the tags.

[0004] Another electronic identification system utilizes a large active transponder device affixed to an object to be monitored which receives a signal from an interrogator. The device receives the signal, then generates and transmits a responsive signal. The interrogation signal and the responsive signal are typically radio-frequency (RF) signals produced by an RF transmitter circuit. Because active devices have their own power sources, and do not need to be in close proximity to an interrogator or reader to receive power via magnetic coupling. Therefore, active transponder devices tend to be more suitable for applications requiring tracking of a tagged device that may not be in close proximity to an interrogator. For example, active transponder devices tend to be more suitable for inventory control or tracking.

[0005] Electronic identification systems can also be used for remote payment. For example, when a radio frequency identification device passes an interrogator at a toll booth, the toll booth can determine the identity of the radio frequency identification device, and thus of the owner of the device, and debit an account held by the owner for payment of toll or can receive a credit card number against which the toll can be charged. Similarly, remote payment is possible for a variety of other goods or services. An electronic identification system which can be used as a radio frequency identification device, and various applications for such devices are described in detail in commonly assigned U.S. patent application Ser. No. 08/705,043, filed Aug. 29, 1996, and incorporated herein by reference.

[0006] For active devices, battery drain is an important issue. The battery may be drained by spurious emissions of the necessary radiation to activate a radio frequency identification device. A power conservation problem is posed by such implementations where batteries are used to supply power to the circuitry of the radio frequency identification device. If the circuitry operates continuously at full power, battery life will be short, and device will have to be frequently replaced. If the battery is permanently sealed in a housing, replacement of the battery will be difficult or impossible. One reason for sealing the battery with the circuitry in a housing is to simplify the design and construction, to reduce the cost of production, and protect the electrical interconnections between devices. Another reason is protection of the battery and circuitry from moisture and contaminants. A third reason is to enhance the cosmetic appeal of the device by eliminating the need for an access port or door otherwise necessary to insert and remove the battery. When the battery is discharged, the entire device is then discarded. It is therefore desirable in such embodiments applications to employ power conservation techniques in order to extend useful life.

[0007] Additionally, for security control, a holder of an active or passive radio frequency identification device may want to prevent unwanted reading of the radio frequency identification device. One potential problem with existing radio frequency identification devices, particularly those with large communication ranges, is that the holder of the device may not have control over when the device is being interrogated. There are times when the holder would want the device to be interrogated, such as to authorize payment. On the other hand, there are other times when the holder would not want the device to be interrogated. For example, if the device is interrogated to seek payment for a particular service, another service provider who is related to or has a marketing deal with the first service provider may seek to solicit business from the holder when the holder enters the premises of the second service provider. There may be sensitive information on the device, such as health information, address information, purchase histories, credit information, that the holder would not want to have accessed without knowledge or approval.

[0008] Therefore, there is a need to provide a holder of a radio frequency identification device with the ability to control whether the device is interrogated.

SUMMARY OF THE INVENTION

[0009] The invention provides a wireless identification device including a housing, and circuitry in the housing configured to provide a signal to identify the device in response to an interrogation signal. A selectively actuated switch is supported by the housing and permits operation of the circuitry only while the switch is actuated.

[0010] In one aspect of the invention, the switch is a momentary switch.

[0011] One aspect of the invention provides a RFID device including a push button switch which allows the RFID device to become temporarily active. The user of the device has control over when the RFID device responds to an interrogator.

[0012] In one aspect of the invention, the switch is coupled to the power supply of an active RFID device, or a power supply receiver in a passive or magnetically coupled device. While the switch is pushed, the RFID device can be interrogated by a reader. In one embodiment, where the switch is coupled to the power supply, the device includes a non-volatile memory.

[0013] In one aspect of the invention, the switch sets a digital circuit flag in an active device to allow the device to operate momentarily. In another aspect of the invention, the switch sets a digital circuit flag in a passive device, when RF power is available, to allow the device to operate momentarily.

[0014] One embodiment of the invention provides a radio frequency identification device comprising an integrated circuit including a receiver, a transmitter, and a microprocessor. In one embodiment, the integrated circuit is a monolithic single die single metal layer integrated circuit including the receiver, the transmitter, and the microprocessor. The device of this embodiment includes an active transponder, instead of a transponder which relies on magnetic coupling for power, and therefore has a much greater range.

[0015] Another aspect of the invention provides a method of manufacturing a wireless identification device. Circuitry is configured to provide a signal to identify the device in response to an interrogation signal. The circuitry is coupled to a selectively actuated switch, such that the circuitry provides the signal only while the switch is actuated. The circuitry is encased in a housing such that the switch is actuable from outside the housing by touching a portion of the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Preferred embodiments of the invention are described below with reference to the following accompanying drawings.

[0017] **FIG. 1** is a high level circuit schematic showing an interrogator and a radio frequency identification device embodying the invention.

[0018] **FIG. 2** is a front view of a housing, in the form of a badge or card, supporting the circuit of **FIG. 1** according to one embodiment the invention.

[0019] **FIG. 3** is a front view of a housing supporting the circuit of **FIG. 1** according to another embodiment of the invention.

[0020] **FIG. 4** is a circuit schematic of an active radio frequency identification device in accordance with one embodiment of the invention.

[0021] **FIG. 5** is a circuit schematic of a passive radio frequency identification device in accordance with one embodiment of the invention.

[0022] **FIG. 6** is a front elevational view, partly broken away, showing construction details of a switch included in the radio frequency identification device of **FIG. 1**.

[0023] **FIG. 7** is a plan view showing construction details of the switch of **FIG. 6**.

[0024] **FIG. 8** is a plan view showing construction details of the radio frequency identification device of **FIG. 1** with the switch of **FIG. 6** being located in accordance with one embodiment of the invention.

[0025] **FIG. 9** is a plan view showing construction details of the radio frequency identification device of **FIG. 1** with the switch of **FIG. 6** being located in accordance with another embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] This disclosure of the invention is submitted in furtherance of the constitutional purposes of the U.S. Patent Laws "to promote the progress of science and useful arts" (Article 1, Section 8).

[0027] **FIG. 1** illustrates a radio frequency data communication device **12** in accordance with one embodiment of the invention. In the illustrated embodiment, the radio frequency data communication device **12** includes RFID circuitry **16**. In the illustrated embodiment, the RFID circuitry is defined by an integrated circuit as described in the above-incorporated patent application Ser. No. 08/705,043, filed Aug. 29, 1996. Other embodiments are possible. A power source **18** is connected to the integrated circuit **16** to supply power to the integrated circuit **16**. In one embodiment, the power source **18** comprises a battery. In an alternative embodiment, the power source comprises a magnetic coil that receives power via magnetic coupling from an external reader as is known in the art; e.g., as disclosed in U.S. Pat. No. 5,113,184 to Katayama. The device **12** further includes at least one antenna **14** connected to the circuitry **16** for radio frequency transmission and reception by the circuitry **16**.

[0028] The device **12** transmits and receives radio frequency communications to and from an interrogator **26**. Preferably, the interrogator unit **26** includes an antenna **28**, as well as dedicated transmitting and receiving circuitry, similar to that implemented on the integrated circuit **16**. Generally, the interrogator **26** transmits an interrogation signal or command **27** via the antenna **28**. The device **12** receives the incoming interrogation signal via its antenna **14**. Upon receiving the signal **27**, the device **12** responds by generating and transmitting a responsive signal or reply **29**. The responsive signal **29** typically includes information that uniquely identifies, or labels the particular device **12** that is transmitting, so as to identify any object or person with which the device **12** is associated. The device **12** includes a selectively actuated switch **30** permitting operation of the circuitry only while the switch is actuated. The switch **30** is coupled to the circuitry **16** or between the power source **18** and the circuitry **16**, as will be described below in greater detail. In one embodiment, the switch **30** is a momentary, touch actuated switch. In one embodiment, the switch **30** is a pressable switch which permits the circuitry **16** to provide the signal to identify the device only while the switch **30** is pressed. More particularly, the switch **30** is a momentary, pressure sensitive switch.

[0029] In the illustrated embodiment in **FIG. 1**, there is no communication between devices **12**. Instead, the devices **12** communicate with the interrogator **26**. Multiple devices **12** can be used in the same field of an interrogator **26** (i.e., within communications range of an interrogator **26**). Similarly, multiple interrogators **26** can be in proximity to one or more of the devices **12**.

[0030] The radio frequency data communication device **12** can be included in any appropriate housing or packaging. Various methods of manufacturing housings are described in commonly assigned U.S. Pat. application Ser. No. 08/800, 037, filed Feb. 13, 1997, and incorporated herein by reference.

[0031] **FIG. 2** shows but one embodiment in the form of a card or badge **19** including the radio frequency data communication device **12**, and a housing **11** including plastic or other suitable material. In one embodiment, the front face of the badge has visual identification features such as graphics, text, information found on identification or credit cards, etc. The switch **30** is supported by the housing **11**.

[**0032**] **FIG. 3** illustrates but one alternative housing supporting the device **12**. More particularly, **FIG. 3** shows a miniature housing **20** encasing the device **12** to define a tag which can be supported by an object (e.g., hung from an object, affixed to an object, etc.). The switch **30** is supported by the housing **20**.

[**0033**] Although two particular types of housings have been disclosed, the device **12** can be included in any appropriate housing.

[**0034**] If the power source **18** is a battery, the battery can take any suitable form. Preferably, the battery type will be selected depending on weight, size, and life requirements for a particular application. In one embodiment, the battery **18** is a thin profile button-type cell forming a small, thin energy cell more commonly utilized in watches and small electronic devices requiring a thin profile. A conventional button-type cell has a pair of electrodes, an anode formed by one face and a cathode formed by an opposite face. In an alternative embodiment, the battery **18** comprises a series connected pair of button type cells. Instead of using a battery, any suitable power source can be employed.

[**0035**] In one embodiment, shown in **FIG. 4**, the circuitry **16** includes a modulator and is configured to provide a signal responsive to an interrogation by the interrogator **26** (**FIG. 1**) other than by magnetic coupling. The circuitry **16** includes an active wireless transponder. In other words, the circuitry **16** includes a transponder that transmits other than via magnetic coupling and that receives its power other than via magnetic coupling. For example, in the embodiment shown in **FIG. 4**, the circuitry **16** includes power terminals **32** and **34**, and the device further includes a battery **36** coupled to the circuitry **16**, via the switch **30**, supplying power to the circuitry **16**. In the embodiment shown in **FIG. 4**, the switch **30** connects the battery **36** to the circuitry **16** while the switch **30** is pressed and disconnects the battery **36** from the circuitry when the switch is not pressed. In the embodiment shown in **FIG. 4**, the circuitry **16** includes non-volatile memory so that the contents of the memory are not lost when the battery **36** is disconnected from the circuitry **16** by the switch **30**. The circuitry **16** further includes a transmitter and is configured to provide a responsive signal to the interrogator **26** by radio frequency. More particularly, in the embodiment shown in **FIG. 4**, the circuitry **16** includes a transmitter, a receiver, and memory such as is described in above-incorporated U.S. patent application Ser. No. 08/705,043. In another embodiment, the circuitry **16** is formed on a printed circuit board, and the switch **30** is added to the printed circuit board as a standard component (e.g., a conventional switch is employed for the switch **30**). This will allow PC board RFID products to be activated as needed.

[**0036**] The circuitry **16** further includes antenna terminals **38** and **40** for a first antenna **41**, and antenna terminals **42** and **44** for a second antenna **46**. One of the antennas **41** and **46** is a send or transmit antenna, and the other of the antennas **41** and **46** is a receive antenna. In the illustrated embodiment, one of the antennas **41** and **46** is a dipole antenna, and the other of the antennas **41** and **46** is a loop antenna. In the illustrated embodiment, the dipole antenna is the send antenna, and the loop antenna is the receive antenna. In alternative embodiments, both antennas **41** and **46** are loop antennas or both antennas **41** and **46** are dipole antennas. Further, in alternative embodiments, a single antenna is used for both sending and receiving. The device of **FIG. 4** further includes a decoupling capacitor **48** coupled between the terminals **32** and **34**.

[**0037**] In another embodiment, shown in **FIG. 5**, the circuitry **16** is configured to provide a signal responsive to an interrogation by the interrogator **26** by magnetic coupling. The circuitry **16** includes an passive wireless transponder. In other words, the circuitry **16** includes a transponder that transmits via magnetic coupling and that receives its power via magnetic coupling. For example, in the embodiment shown in **FIG. 5**, the circuitry **16** includes power terminals **50** and **52**, and the device further includes a coil **54** coupled to the circuitry **16**, via the switch **30**, supplying power to the circuitry **16**. In the embodiment shown in **FIG. 5**, the switch **30** connects the coil **54** to the circuitry **16** while the switch **30** is pressed and disconnects the coil **54** from the circuitry when the switch **30** is not pressed. In the embodiment shown in **FIG. 5**, the circuitry **16** includes non-volatile memory so that the contents of the memory are not lost when the coil **54** is disconnected from the circuitry **16** by the switch **30**. The circuitry **16** further includes a transmitter and is configured to provide a responsive signal to an interrogator by magnetic coupling.

[**0038**] The circuitry **16** further includes terminals **56** and **58** for a coil **60** which is used for communications to and from an interrogator by magnetic coupling which power is received by coil **54**. In alternative embodiments, separate coils are used for sending and receiving. The device of **FIG. 5** further includes a decoupling capacitor **48** coupled between the terminals **50** and **52**.

[**0039**] A method of manufacturing a device **12** as shown in FIGS. **2-4** will now be described, reference being made to FIGS. **6-8**.

[**0040**] The device **12** includes a housing defined in part by a substrate or layer of supportive material **62**. The term "substrate" as used herein refers to any supporting or supportive structure, including, but not limited to, a supportive single layer of material or multiple layer constructions. In the illustrated embodiment, the substrate **62** comprises a polyester film. Other materials are possible. In one embodiment, the polyester film is provided in a roll, using which a number of similar or identical devices are fabricated at the same time and in an assembly line manner. In one embodiment, one or more layers of ink are printed on an inner side of the polyester film facing (after assembly) the back of the device to convey information such as logos and/or company names.

[**0041**] Conductive ink **64** is formed or applied over the substrate **62** and over any ink. In the illustrated embodiment, the conductive ink **64** comprises PTF (polymer or printed thick film; e.g., a polymer filled with flecks of metal such as silver or copper). One manner of forming or applying the conductive ink on the substrate is to screen print the ink on the substrate through conventional screen printing techniques. The conductive ink forms conductive traces for desired electrical connections with and between electronic components which will be described below. In one embodiment, where the smart card is capable of radio frequency communications, the conductive ink is further used to define the antennas **41** and **46** (see **FIGS. 8 and 9**). In instances where substrate **62** forms a portion of a larger roll of polyester film material, the printing of conductive ink **64** can take place simultaneously for a number of the to-be-formed devices. A gap **66** is provided along a trace of the conductive ink **64** to define spaced apart ends or terminals **68** and **70** (**FIGS. 6 and 7**) for the switch **30**. The spaced apart terminals **68** and **70** cause an open circuit unless they are electrically coupled together.

[**0042**] Conductive epoxy **72** is applied over desired areas (**FIG. 8**) using a syringe dispenser to assist in component attachment described just below. In one embodiment, solder is employed instead of conductive epoxy. Referring to **FIGS. 8 and 9**, the battery **36** is provided and mounted on each substrate **62** using the conductive epoxy. The battery **36** is preferably a thin profile battery which includes first and second terminals. More particularly, the battery **36** has a lid or negative terminal, and a can or positive terminal. In an alternative embodiment, multiple batteries are provided (e.g., coupled together in series or parallel).

[**0043**] An integrated circuit defining the RFID circuitry **16** is provided and mounted on each of the substrates **62** using the conductive epoxy (e.g., picked and placed using surface mounting techniques). An exemplary and preferred integrated circuitry is described in U.S. patent application Ser. No. 08/705,043 incorporated by reference above. The capacitor **48** is similarly provided and mounted.

[**0044**] The device **12** includes a first or negative battery connection **74** and a second or positive battery connection **76** defined by PTF. The first battery connection is coupled to the integrated circuit by the conductive epoxy, and the second battery connection terminal is coupled to the integrated circuit by the conductive epoxy. In the illustrated embodiment, the battery **36** is placed lid down such that the conductive epoxy makes electrical contact between the negative terminal of the battery and a portion of the first battery connection **74** that extends underneath the lid of the battery in the views shown in **FIGS. 8 and 9**.

[**0045**] The battery has a perimetral edge which is disposed adjacent the second battery connection **76**. Conductive epoxy is dispensed relative to battery perimetral edge and electrically connects the perimetral edge with an adjacent arcuate portion of the second battery connection **76**. In the illustrated embodiment, the perimetral edge defines the can of the battery, such that the conductive epoxy connects the positive terminal of the battery to the battery connection terminal **76**.

[**0046**] The conductive epoxy is then cured.

[**0047**] Subsequently, encapsulating epoxy material is provided to encapsulate the substrates, to cover the integrated circuits and batteries, and conductive traces and to define a second housing portion. After application and curing of such epoxy, the a suitable separation or singulation process takes place if multiple devices were formed simultaneously.

[**0048**] At any time after the conductive ink **64** is applied and before the encapsulating epoxy is provided, an insulating ring **78** is placed over a certain portion of the PTF **64**. The insulating ring **78** has a periphery **80** and is positioned such that the periphery **80** circumscribes the ends **68** and **70** (see **FIG. 7**). A diaphragm **82** having a periphery **84** corresponding in size and shape to the periphery **80** of the insulating ring **78** is placed over the insulating ring **78** such that the insulating ring spaces the diaphragm **82** from the ends **68** and **70**. The diaphragm **82** has a conductive face **86** facing the ends **68** and **70**. Thus, after construction of the device **12**, pushing on an area **88** of the flexible substrate **62** causes the ends **68** and **70** to move into contact with the conductive face **86** of the diaphragm **82**, thus causing an electrical connection to be made between the ends **68** and **70**. The diaphragm **82** does not move away from the ends **68** and **70** because the encapsulant is positioned above the diaphragm **82**, and the encapsulant is substantially rigid.

[**0049**] **FIGS. 8 and 9** illustrate alternative possible locations for the gap **66** and thus for the switch **30**. In the embodiment of **FIG. 8**, the gap **66** is provided along a battery connection. Thus, unless the switch **30** is pressed and held, no power is available to the circuitry **16**. The embodiment of **FIG. 8** can be used where the circuitry **16** includes non-volatile memory or where no important information is lost if power is disconnected. In the embodiment of **FIG. 9**, the gap **66** is not provided along a battery connection. Instead, the embodiment of **FIG. 9** is one to be used when the circuitry **16** does not employ non-volatile memory. In the embodiment of **FIG. 9**, the switch is provided between pins of the circuitry **16** used to set a digital flag described above.

[**0050**] In compliance with the statute, the invention has been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the invention is not limited to the specific features shown and described, since the means herein disclosed comprise preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the proper scope of the appended claims appropriately interpreted in accordance with the doctrine of equivalents.

1. A wireless identification device comprising:

a housing;

circuitry in the housing configured to provide a signal to identify the device in response to an interrogation signal; and

a selectively actuated switch supported by the housing and permitting operation of the circuitry only while the switch is actuated.

2. A wireless identification device in accordance with claim 1 wherein the switch is a momentary switch.

3. A wireless identification device in accordance with claim 1 wherein the switch is a pressure sensitive switch.

4. A wireless identification device in accordance with claim 1 wherein the switch is a momentary, touch actuated switch.

5. A radio frequency identification device in accordance with claim 1 wherein the device further includes a battery supplying power to the circuitry.

6. A radio frequency identification device comprising:

a housing;

circuitry in the housing configured to provide a signal to identify the device in response to an interrogation signal; and

a pressable switch supported by the housing and permitting the circuitry to provide the signal to identify the device only while the switch is pressed.

7. A radio frequency identification device in accordance with claim 6 wherein the circuitry includes an active wireless transponder, and wherein the device further includes a battery supplying power to the circuitry.

8. A radio frequency identification device in accordance with claim 7 wherein the switch connects the battery to the circuitry while the switch is pressed and disconnects the battery from the circuitry when the switch is not pressed.

9. A radio frequency identification device in accordance with claim 8 wherein the circuitry includes non-volatile memory.

10. A radio frequency identification device in accordance with claim 6 wherein the circuitry includes a transmitter and is configured to provide the signal by radio frequency.

11. A radio frequency identification device in accordance with claim 6 wherein the circuitry includes a modulator and is configured to provide the signal other than by magnetic coupling.

12. A radio frequency identification device in accordance with claim 6 wherein the device includes a coil configured to receive power from an interrogator by magnetic coupling.

13. A radio frequency identification device in accordance with claim 12 wherein the switch connects the coil to the circuitry while the switch is pressed and disconnects the coil from the circuitry when the switch is not pressed.

14. A radio frequency identification device in accordance with claim 13 wherein the circuitry is configured to provide the signal to the interrogator by magnetic coupling.

15. A radio frequency identification device in accordance with claim 6 wherein the circuitry includes digital circuitry including a digital flag which is set when the switch is pressed and cleared when the switch is released, and wherein the circuitry polls the flag and does not provide the signal to identify the device except when the flag is set.

16. A radio frequency identification device in accordance with claim 15 wherein the circuitry includes volatile memory.

17. A radio frequency identification device comprising:

a printed circuit board configured to provide a signal to identify the device in response to an interrogation signal; and

a pressable switch on the printed circuit board and permitting the circuitry to provide the signal to identify the device only while the switch is pressed.

18. A radio frequency identification device comprising:

a housing;

a battery in the housing having first and second terminals of opposite polarity;

an integrated circuit in the housing configured to provide a signal to identify the device in response to an interrogation signal, the integrated circuit having a first power terminal coupled to the first terminal of the battery and having a second power terminal; and

a selectively pressed switch supported by the housing and connecting the circuitry to the battery only while the switch is pressed, the switch including a first conductor formed of printed thick film and having a first end coupled to the second terminal of the battery and having a second end, a second conductor formed of printed thick film and having a first end coupled to the second power terminal of the circuitry and having a second end spaced apart from the second end of the first conductor, an insulating ring having a periphery circumscribing the second end of the first conductor and the second end of the second conductor, a diaphragm having a periphery corresponding to the periphery of the insulating ring, and having a conductive face facing the second end of the first conductor and the second end of the second conductor, the conductive face of the diaphragm being spaced apart from the first and second conductors by the insulating ring.

19. A radio frequency identification device in accordance with claim 18 wherein the housing further includes an encapsulant over the diaphragm.

20. A radio frequency identification device in accordance with claim 18 wherein the housing further includes a polyester film substrate, wherein the printed thick film is formed over the substrate, and wherein the housing is configured to effect connection of the second ends of the first and second conductors when pressure is applied to the substrate at location facing the diaphragm.

21. A radio frequency identification device in accordance with claim 18 wherein the integrated circuit and the battery are located between the polyester substrate and the encapsulant.

22. A radio frequency identification device comprising:

a housing including a substrate and encapsulant over the substrate;

a battery supported in the housing having first and second terminals of opposite polarity;

circuitry in the housing configured to provide a signal to identify the device in response to an interrogation signal; and

a selectively pressable switch formed in the housing between the substrate and the encapsulant and connecting the circuitry to the battery only while the switch is pressed.

23. A radio frequency identification device in accordance with claim 22 wherein the substrate comprises a polyester film.

24. A radio frequency identification device in accordance with claim 22 wherein the switch includes a first conductor formed of printed thick film and having a first end coupled to the battery and having a second end, a second conductor formed of printed thick film and having a first end coupled to the circuitry and having a second end spaced apart from the second end of the first conductor, an insulating ring having a periphery circumscribing the second end of the first conductor and the second end of the second conductor, and a diaphragm having a periphery corresponding to the periphery of the insulating ring and having a conductive face facing the second end of the first conductor and the second end of the second conductor.

25. A method of manufacturing a wireless identification device, the method comprising:

configuring circuitry to provide a signal to identify the device in response to an interrogation signal;

coupling the circuitry to a selectively actuated switch, such that the circuitry provides the signal only while the switch is actuated; and

encasing the circuitry in a housing such that the switch is actuable from outside the housing by touching a portion of the housing.

26. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the circuitry to a momentary switch.

27. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the circuitry to a pressure sensitive switch.

28. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the circuitry to a momentary, touch actuated switch.

29. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the switch between the circuitry and a power supply.

30. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the switch between the circuitry and a battery.

31. A method of manufacturing a wireless identification device in accordance with claim 30 wherein the encasing comprises encasing the battery and the circuitry.

32. A method of manufacturing a wireless identification device in accordance with claim 25 wherein the coupling comprises coupling the switch between the circuitry and a button type battery, and wherein the encasing comprises encasing the battery and the circuitry and the switch.

33. A method of manufacturing a wireless identification device, the method comprising:

supporting a battery on a film substrate, the battery having first and second terminals of opposite polarity;

supporting circuitry on the substrate to provide a signal to identify the device in response to an interrogation signal;

forming a selectively pressable switch on the substrate and coupling the switch to the battery and the circuitry to connect the circuitry to the battery only while the switch is pressed; and

flowing an encapsulant over the circuitry, switch, and battery to define a housing including the encapsulant and the substrate.

34. A method of manufacturing a wireless identification device in accordance with claim 33 wherein forming the switch comprises printing thick film on the substrate to define a first conductor having a first end coupled to the battery and having a second end, and a second conductor having a first end coupled to the circuitry and having a second end spaced apart from the second end of the first conductor, placing an insulating ring such that its periphery circumscribes the second end of the first conductor and the second end of the second conductor, and placing a diaphragm over the insulating ring, the diaphragm having a periphery corresponding to the periphery of the insulating ring and having a conductive face facing the second end of the first conductor and the second end of the second conductor.

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