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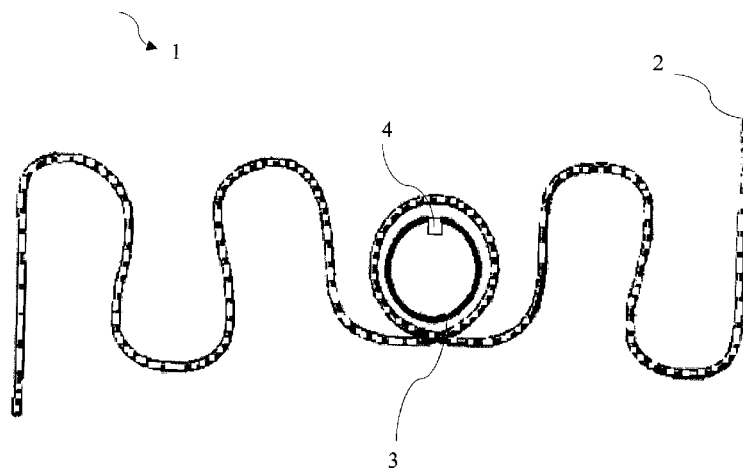


Figure 1

(57) Abstract: The present invention relates to RFID (Radio Frequency identification) tags which communicate by radio frequencies and can store information therein. The objective of the present invention is to provide an RFID tag which provides a stronger action/reaction, thus better communication.

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ENHANCED ANTENNA STRUCTURE FOR RFID TAGS

Field of the Invention

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The present invention relates to RFID (Radio Frequency Identification) tags which communicate by radio frequencies and can store information therein.

Background of the Invention

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RFID is a method for automatic identification of objects by using radio frequencies. It is basically comprised of a reader and a tag. The tags comprise a chip for performing the functions of receiving, storing and sending information related to the object and antennas which surround the said chip for supplying
15 energy to it and activating it. The chip and antennas are coated with a coating and attached to the object to be identified.

There are two types of tags, namely active and passive. The passive tags do not have their own power supplies. The antennas collect energy from the
20 electromagnetic waves emitted by the reader serving as a transmitter in order to activate the chip. Energy collection is the technique of keeping the energy coming from the reader for an instant, activating the chip and then sending it back to the reader. This technique can enhance the performance of the passive tags significantly. The electromagnetic waves emitted by the reader meet with the chip
25 as an energy and activate it, and data transfer is made from the tag to the reader via antennas.

The structure of the antennas is generally comprised of a loop antenna and a dipole antenna. The chip including information is positioned on the loop antenna.
30 When data is being transferred from the antennas to the reader, initially the dipole antenna collects energy from the electromagnetic waves emitted by the reader, a

current is generated thereon. When this current generated on the dipole antenna moves, it causes a current on the loop antenna as well.

5 This current on the loop antenna is created by either the physical connection or inductive coupling between the dipole antenna and loop antenna. If the current is provided by the physical connection, these two antennas behave as parallel connected circuit elements. On the other hand, the same physical connection serves as a kind of short circuit. This prevents the entire current on the dipole antenna from passing also over the loop antenna.

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In systems which utilize inductive coupling and in which there is no physical connection between the dipole antenna and the loop antenna, the two antennas are positioned close to each other. The magnetic field created by the current on the dipole antenna creates induction current on the loop antenna. In this case, since
15 the current on the dipole antenna cannot make a full trip around the loop antenna, only a part of its potential reaches the chip. The chip is energized in proportion to the current on the loop antenna and provides an action and reaction again in the same proportion. The fact that the inductive coupling area where the two antennas come close to each other is limited causes the current generated on the chip to be
20 weak and thus the action-reaction obtained to be low in power.

Summary of the Invention

The objective of the present invention is to provide an RFID tag with enhanced
25 performance.

Detailed Description of the Invention

Enhanced antenna structure for RFID tags developed to fulfill the objective of the
30 present invention is illustrated in the accompanying figures wherein,

Figure 1 is the top perspective view of the enhanced antenna structure.

Figure 2 is the side perspective view of the enhanced antenna structure.

Figure 3 is the schematic view of operation of RFID tags with the reader and computer.

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The components in the figures are assigned reference numerals as follows:

- 1. Enhanced antenna structure
- 2. Dipole antenna
- 10 21. Sinusoidal part
- 22. Circular part
- 23. Crossing part
- 3. Loop antenna
- 4. Microchip
- 15 E. RFID tag
- F. Reader
- G. Computer

The antenna structure (1) of the present invention, which allows realizing an
20 RFID tag that provides enhanced action/reaction, essentially comprises

- at least one dipole antenna (2) which is coated with an insulating film and is comprised of a conductive material,
 - at least one sinusoidal part (21) forming one pole of the dipole antenna (2),
 - 25 ○ at least one circular part (22) which produces a toroidal magnetic field around itself,
 - at least one crossing part (23) which overlaps when the dipole antenna (2) bends to form the circular part (22) and which does not cause short circuit since the dipole antenna is insulated,
 - 30 which constitute the dipole antenna (2);

- at least one loop antenna (3) which is surrounded by the circular part (22) and comprised of a conductive material,
- at least one microchip (4) which is located on the loop antenna and which is adapted to receive, store and/or send the information related to the object to be identified.

In the antenna structure (1) of the present invention, an electric current is generated on the dipole antenna (2) when it is positioned in the electromagnetic field generated by the electromagnetic waves at the predetermined frequencies sent by the reader (F). While the said electric current flows on the dipole antenna (2), an electric current is generated also on the loop antenna (3) with the impact of inductive coupling.

The loop antenna (3) is surrounded by the circular part (22) of the dipole antenna (2). As the dipole antenna (2) bends to form the circular part (22) surrounding the loop antenna (3), a crossing (23) is formed between the sinusoidal parts (21) which overlap. Since the dipole antenna (2) is coated with an insulating film material, a short circuit is prevented from occurring at the overlapping crossing part (23). Thus the electric current is allowed to flow along the entire dipole antenna (2) such that it will completely surround the loop antenna (3).

Thus the electric current flowing along the dipole antenna (2) makes a full trip around the loop antenna (3) remaining in the circular part (22). Throughout the full circumference, the loop antenna (3) is inducted. The loop antenna (3), on which enhanced induction current is generated, activates the microchip (4) that includes the information related to the object to be identified.

The information on the activated microchip (4) is sent to the reader (F) by radio waves via the loop antenna (3) and the dipole antenna (2) comprising sinusoidal part (21), circular part (22) and crossing part (23). The reader (F), upon receiving

the information, converts this information into digital data and transfers it to the computer.

By means of the enhanced antenna structure for RFID tags (1) of the present invention, better communication quality between the RFID tags (E) and the readers (F) is achieved. The current flowing on the dipole antenna (2) coated with an insulating film induces current on the loop antenna (3) with full capacity and the energizing rate of the microchip (4) on the loop antenna (2) is increased. This increase enables the microchip (4) to provide a stronger response than the structures used in the prior art and thereby allows designing stronger and more efficient RFID tags (E).

In another preferred embodiment of the invention, the crossing part (23) is insulated by placing an insulating material between the overlapping parts and thus short circuit is again prevented.

Within the framework of these basic concepts, it is possible to develop a wide variety of embodiments of the enhanced antenna structure for RFID tags (1) of the present invention. The invention can not be limited to the examples described herein and it is essentially as defined in the claims.

CLAIMS

1. Enhanced antenna structure for RFID tags (1), which allows realizing an RFID tag that provides strong action/reaction, essentially **comprising**
- 5 - at least one microchip (4) which is located on the loop antenna and which is adapted to receive, store and/or send the information related to the object to be identified; and **characterized by**
- at least one dipole antenna (2) which is coated with an insulating film and is comprised of a conductive material;
- 10 -
- at least one sinusoidal part (21) forming one pole of the dipole antenna (2),
- at least one circular part (22) which produces a toroidal magnetic field around itself,
- 15 ○ at least one crossing part (23) which overlaps when the dipole antenna (2) bends to form the circular part (22) and which does not cause short circuit since the dipole antenna (2) is insulated,
- which constitute the dipole antenna (2);
- at least one loop antenna (3) which is surrounded by the circular part (22)
- 20 and comprised of a conductive material.
2. Enhanced antenna structure for RFID tags (1) according to Claim 1, **characterized by** the loop antenna (3) on which an electric current is generated with the impact of inductive coupling when an electric current flows
- 25 on the dipole antenna (2).
3. Enhanced antenna structure for RFID tags (1) according to any one of the preceding claims, **characterized by** the loop antenna (3) which activates the microchip (4).

30

4. Enhanced antenna structure for RFID tags (1) according to any one of the preceding claims, **characterized by** the loop antenna (3) and the dipole antenna (2) which send the information on the activated microchip (4) to the reader (F) by radio waves.

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5. Enhanced antenna structure for RFID tags (1) according to any one of the preceding claims, **characterized by** the crossing part (23) which is insulated by placing an insulating material between the overlapping parts.

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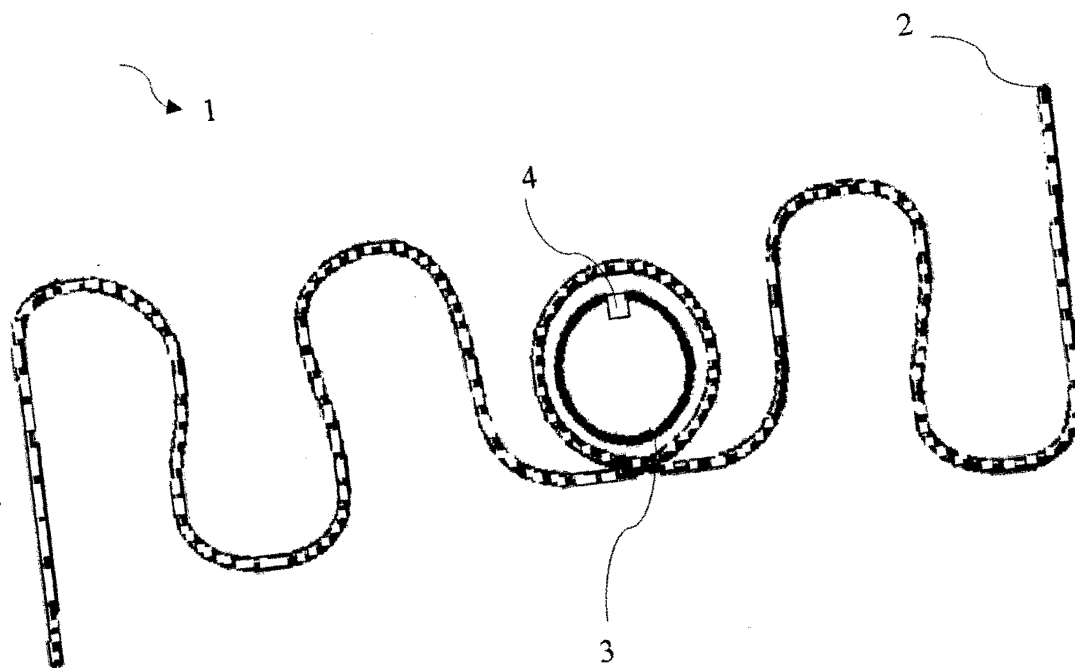


Figure 1

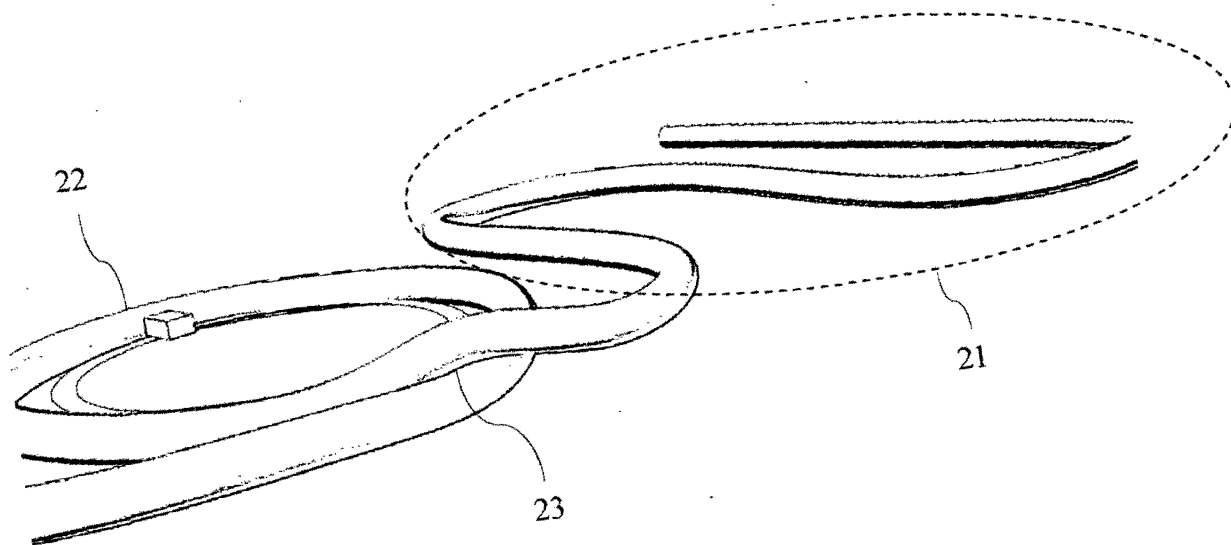


Figure 2

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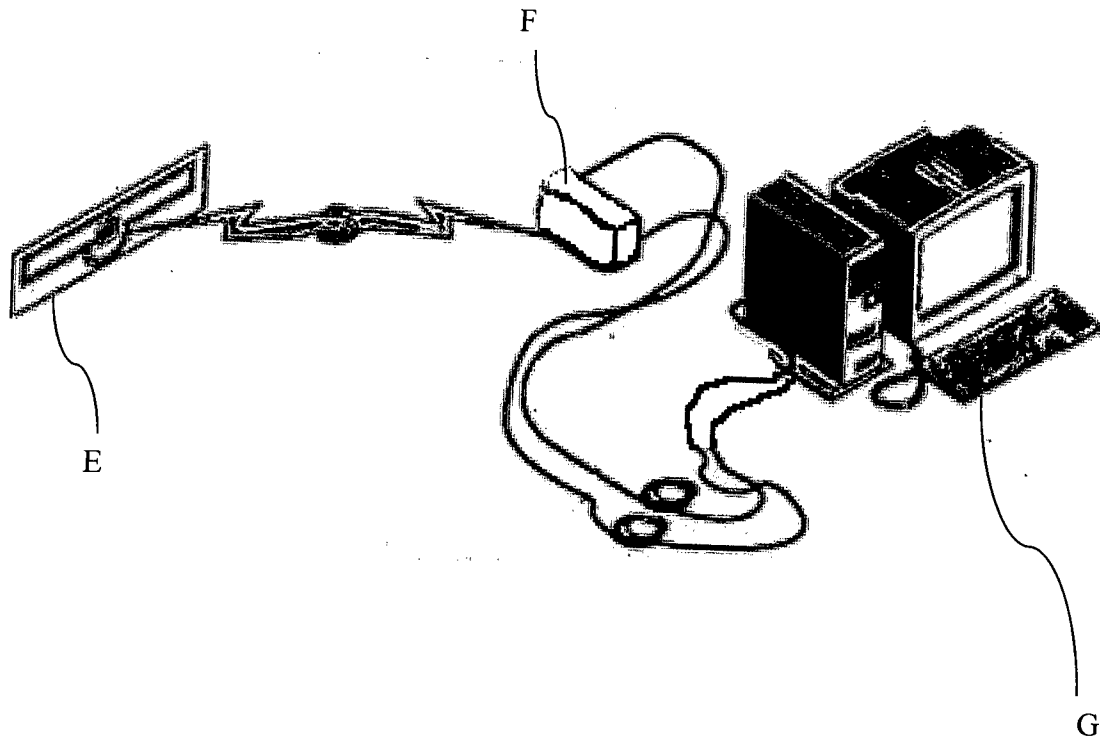


Figure 3