Title: A SYSTEM AND A METHOD FOR ELECTRONICALLY MONITORING GOODS

Abstract: A system for electronically monitoring goods for use as antitheft measure in a shop. The system comprises: electric circuits suitable for being attached to an item, one or more electromagnetic examination zones in which said electric circuits can be detected by use of antennae, and a metal detecting zone wherein metallic items can be detected by means of a metal detector. The metal detector comprises two antennae, viz. a transmitter and a receiver of electromagnetic signals. In use the signal to a receiver antenna will contain information on the cross-sectional area of a metallic item, if any, projected onto the antenna. The particular features of the system are that the one of the two antennae of the metal detector is oriented horizontally or substantially horizontally and is arranged above the metal detecting zone, while the other one of the antennae of the metal detector is oriented horizontally or substantially horizontally and is arranged below the metal detecting zone.
The present invention relates to a system for electronically monitoring goods which is suitable as an anti-theft measure in a shop, comprising electric circuits suitable for being attached to the individual item; one or more electromagnetic examination zones in which said electric circuits can be detected by means of antennae; a metal detection zone in which metallic objects can be detected by means of a metal detector, said metal detector comprising two antennae: a transmitter and a receiver. It applies that, in use, the signal to a receiver antenna will contain information on the cross-sectional area of a metal object, if any, projected onto the antenna.

A conventional system for electronically monitoring goods, eg to prevent shoplifting, functions in that a transmitter induces a signal in a circuit which is located on the individual item. The signal is captured by a receiver. The circuit may be an oscillating circuit containing a coil and optionally a capacitor, or it may be an integrated circuit (a chip) which, apart from serving as anti-theft measure, may also be used eg for storage-control. The term 'electric circuit' as used in the following is intended to also comprise the use of a piece of metal, like in an acousto-magnetic system where a strip of metal is caused to oscillate or like in an electro-magnetic system where the hysteresis properties of the metal are used to advantage. Often the circuit is removed from the item when the item is paid for or, otherwise, it is deactivated when the item is paid for. The transmitter and receiver are arranged such that they are not to be passed until the item has been paid for. Thus, only in case the item has not been paid for, is the circuit caused to enter the transmitter/receiver area and is able to release an alarm, if any, which is coupled thereto.

It is a prerequisite for this arrangement to work that the electric circuit is not shielded from the electromagnetic field from the transmitter or the antenna.
Such shielding could be in the shape of a metal container. Among shoplifters, that way of bypassing systems for electronically monitoring goods is known.

From EP 0 736 850 B1 it is known to manufacture a system for electronically monitoring goods, wherein the conventional system is supplemented with a metal detector which is used to reveal attempts to shield the circuit arranged on the individual item. Shielding of the circuit arranged on the individual item may typically be accomplished by arranging the item in a metal container, eg a bag lined with metal foil. However, the use of such bag could be revealed by means of a metal detector.

In EP 0 736 850 B1 it is described how the same set of antennae is used both to detect the circuits used to tag the individual item and, moreover, as antennae for a metal detector.

A metal detector is able to detect only whether a bag contains metal or not and to indicate the amount of metal and the spatial distribution of the metal. The spatial distribution may be estimated by the signal from the receiver antenna being reduced compared to the projected area of the metal located between the transmitter and receiver antennae. However, it will not provide any conclusive information whether a bag contains or is made like a metal container which is able to shield circuits to the effect that they cannot be detected. The clearer the signal obtained from the metal detector, the better the options of identifying metal containers. This is crucial since it is desired to identify only such metal containers as can be used for shoplifting.

It is an option for the shop to monitor individuals that have been registered to bring along a metal container to the shop. This means that a shop detective, if any, will be able to concentrate on monitoring a smaller number of individuals who have been identified to bring along a metal container which is suitable for shielding the circuit of tagged goods. It is crucial to such strategy
that the metal detector is as sensitive and accurate as possible to the effect that resources are not wasted monitoring individuals that bring along bags with other metallic contents.

It is an option for shoplifters to evade such monitoring that the shoplifter brings along a collapsed metal container, eg in the shape of a metal foil bag which does not trigger a readily suspicious signal from the metal detector. Such metal container may subsequently be unfolded inside the shop. The known systems do not take this option into account.

It is a further problem of the prior art systems that, eg as described in EP 0 736 850 B1, that, when the same antennae or antennae that are arranged close to each other are used both as metal detector and for detection of tagged goods, a field from the one type of antenna will be induced directly into the other type of antenna, to be understood such that the signals from the two types of antenna systems will interfere with each other. This will influence the overall signal to noise ratio, thereby reducing the sensitivity of the system. Conventionally the problem is remedied by the two systems using different frequency areas, where it is usually possible to select the frequency area of the metal detector within different frequency areas, enabling selection of the frequency area which is influenced the least possible by the current system used for tagging goods. However, some noise will still be induced which entails reduced sensitivity.

These problems have been solved by the present invention in that it provides a system for electronically monitoring goods wherein the one of the two antennae of the metal detector is oriented horizontally or essentially horizontally and is arranged above the metal detecting zone, while the other one of the antennae of the metal detector is oriented horizontally or essentially horizontally and is arranged below the metal detecting zone.
The invention according to claim 1 thereby solves the above problems in that it is possible to arrange the metal detection zone concealed within the shop and that the antennae are arranged horizontally above and below the metal detection zone.

Preferably the antennae for detection of electric circuits are oriented vertically.

According to a preferred embodiment it is the signal from the receiver antenna that contains information on the cross-sectional area of a metal object projected onto the antenna.

According to a further embodiment an examination zone in which said electric circuit can be detected will completely or partially overlap the metal detection zone in which metallic objects can be detected.

According to an alternative embodiment the antennae for detection of electric circuits are arranged horizontally.

According to a further embodiment the lowermost antenna of the metal detector which is arranged below the metal detecting zone is hidden in the floor.

According to a further embodiment the uppermost antenna of the metal detector which is arranged above the metal detection zone is hidden in the ceiling.

According to a further embodiment the metal detector is connected to an electronic surveillance system, eg a video camera, which may be activated when a metallic object is detected in said metal detection zone.
According to a further embodiment coinciding examination zones and metal detecting zones are arranged in several places in the shop to the effect that a person carrying, in a first metal detecting zone, one given number of goods provided with an electric circuit will, later on and in another metal detecting zone, carry a smaller number of goods, can be registered. This will be relevant in areas around the shop which are monitored with difficulty and where an item can more easily be put in a metal container.

Also, the invention relates to a method of establishing antitheft measures in shops wherein electric circuits are arranged on some goods; and wherein an examination zone is established which is delimited by two antennae in which said circuit can be detected; and wherein a metal detection zone is established which is delimited by two antennae in which metal objects can be detected by means of a metal detector, whereby the metal detecting zone is hidden in that the requisite antennae are arranged horizontally above and below the metal detecting zone.

Preferably the antennae for detection of electric circuits are oriented vertically.

According to a further embodiment of this method the antenna is hidden underneath the metal detecting zone in the floor. According to a further embodiment of this method the antenna is hidden above the metal detecting zone in the ceiling.

The invention according to the present application will now be described with reference to the figures.

Figure 1 shows the prior art with two antennae systems arranged next to each other, vertically.
Figure 2 shows the arrangement of the two antenna systems according to the invention.

Figure 3 shows an embodiment in which the antennae for the metal detector are arranged in their own areas and are hidden in the floor and in the ceiling, respectively.

Figure 1 shows the arrangement of, on the one hand, the antenna system for detection of tagged goods: antenna 1 and antenna 2, and, on the other, the antenna system that serves as metal detector: antenna 3 and antenna 4. Usually it will apply to both types of antenna systems that the length L is considerably longer than the widths W₁ and W₂, most often by a factor 3 or more. The length L is often 1.5 - 1.7 m, while the width W₁ is typically 0.3 - 0.5 m, and the width W₂ is typically 0.1 - 0.2 m. The distance for passage between antennae a will usually be within the range 1.4 - 2.2 m, while the distance b between the two different sets of antennae will typically be 0.1 - 0.3 m. The distance b not being larger means that a quite considerable contribution will be induced eg from antenna 1 to antenna 2.

Figure 2 shows an example of arrangement of the antennae 5 and 6 of the metal detector in accordance with the invention. The antenna 5 is arranged above the metal detecting zone, eg concealed in the ceiling or suspended from the ceiling. The antenna 6 is arranged below the metal detecting zone, eg integrally with a mat on the floor or concealed in the floor as such. The antennae being hidden means that, in this context, it is not possible to see anything but the ordinary floor or ceiling which is already present in the shop as such. Thus it will not be possible for shoplifters to guess where the antennae are arranged. As it is, the antennae as such are almost always encapsulated in some other material and hence they are not directly visible, but potential shoplifters will be able to identify their location. Typically, antennae 1-6 will consist of one or more coils of a conductive material, eg a
metal wire. Such antenna is easily arranged in a groove cut in both flooring and ceiling materials.

In Figure 2, the antenna 5 is arranged the distance g above the antennae 1 and 2. The distance g will typically be 1 - 2 m. This means that the field induced from antennae 1 and 2 into antenna 5 will be considerably smaller than in the case for the known arrangement of the antennae shown in Figure 1, where the distance between the two antenna systems b will usually be 0.1 - 0.3 m.

Therefore, antenna 5 will often be chosen to be the receiver antenna. Another important difference between the embodiment of Figure 2 and the prior art shown in Figure 1 is that, in Figure 1, the antennae of the two different systems are arranged above one opposite each other along the long dimension (L) of the antennae, while, in the two separate systems of Figure 2, the antennae are arranged opposite each other along the short dimension (W1 and W2) of the antennae. This also means that, as regards the system of Figure 2, less noise is induced from one system to the other compared to the system of Figure 1.

Thus both the facts that the distance g is larger than the distance b and that the antenna face towards each other along their short dimensions (W1 and W2) for the embodiment shown in Figure 2, mean that a considerably smaller field is induced from the antennae 1 and 2 for detecting a tagging circuit and into the antennae 5 and 6 to the metal detector. Hereby a considerably increased sensitivity of the metal detector is accomplished and hence an improved option of distinguishing between a metal container suitable for shielding circuits for tagging goods from other metallic objects.

Figure 3 shows an example where the metal detecting zone is arranged independently of the examination zone for detecting the electric circuits.
the same time it is outlined that the antenna 5 is hidden in or above the ceiling 10 and that the antenna 6 is hidden in or below the floor 11. One practical option could be to mount, in advance, the antennae on a part of the ceiling boards and flooring materials used, which antennae are subsequently to be connected as needed. This can be accomplished by laying a metal wire, eg in a cut groove, into the rear side of floor boards and ceiling boards. An embodiment like the one shown in Figure 3 will be suitable for being arranged in strategically important places in a shop area. That could be in the vicinity of groups of goods that are particularly exposed to attempted theft. An individual who carries a collapsed metal container into a shop and who subsequently unfolds it would be revealed by such hidden metal detecting zone arranged within the shop as such. When the metal detector registers a metal container suitable for shielding electric circuits used for tagging goods in the shop, it may be coupled to an alarm that links to a shop detective and/or to a surveillance camera.

It will be possible to arrange several such metal detecting zones in a shop as needed.

The antennae shown in the three figures are illustrated schematically only. In practice they may assume a wide variety of shapes and, as mentioned, they will usually be wrapped in some kind of frame. Alternatively, they will be integral with - and hence completely concealed in - the materials that partake as ceilings, floors or walls in the shop. The requisite transmitter and receiver circuits and equipment for signal processing and analysis of results and emission of an alarm, if any, are not included in the figures either since, usually, they will be known standard components.
Claims

1. A system for electronically monitoring goods for use as antitheft measure in a shop, comprising:

- electric circuits suitable for attachment to an item;
- one or more electromagnetic examination zones, in which said electric circuits can be detected by use of antennae (1,2);
- a metal detecting zone (20), in which metallic items may be detected by means of a metal detector;
- said metal detector comprising two antennae (5, 6), viz a transmitter and a receiver of electromagnetic signals;

   to which it applies that, in use, the signal to a receiver antenna (5, 6) will contain information on the cross-sectional area of a metal object, if any, projected onto the antenna,

   characterised in that

   the one of the two antennae (5, 6) of the metal detector is oriented horizontally or essentially horizontally and is arranged above the metal detecting zone, while the other one of the antennae of the metal detector is oriented horizontally or essentially horizontally and is arranged below the metal detecting zone; and in that the antennae (1, 2) for detection of electric circuits are oriented vertically.

2. A system according to claim 1, characterised in that an examination zone in which said electric circuit can be detected completely or partially overlaps the metal detection zone in which metallic items can be detected.

3. A system according to any one of the preceding claims, characterised in that the antenna for the metal detector arranged below the metal detecting zone is hidden in the floor.
4. A system according to any one of the preceding claims, characterised in that the antenna for the metal detector arranged above the metal detecting zone is hidden in the ceiling.

5. A system according to any one of the preceding claims, characterised in that the metal detector is connected to an electronic surveillance system which can be activated when, in said metal detecting zone, a metallic item is detected.

6. A system according to any one of the preceding claims, characterised in that, in several places in the shop, coinciding examination zones and metal detecting zones are arranged to the effect that a person who, in a first metal detecting zone, carries a given number of goods provided with an electric circuit, who later, in another metal detection zone, carries a smaller number of goods, can be registered.

7. A system according to any one of the preceding claims, characterised in that, at an entry to the shop where there is no exit, a metal detecting zone is arranged.

8. A method of establishing antitheft measures in shops where electric circuits are arranged on some goods, and where an examination zone is established which is delimited by two antennae in which said circuit could be detected, and wherein a metal detecting zone is established delimited by two antennae whereby metallic items can be detected by means of a metal detector, characterised in that the metal detection zone is hidden in that the requisite antennae are arranged horizontally above and below the metal detecting zone.
9. A method of establishing antitheft measures according to claim 8, characterised in that said antenna below the metal detecting zone is hidden in the floor.

10. A method of establishing antitheft measures according to claim 8, characterised in that said antenna above the metal detecting zone is hidden in the ceiling.
Fig. 1

Fig. 2
Fig. 3
INTERNATIONAL SEARCH REPORT
International application No
PCT/DK2007/000397

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01V3/10 G08B13/24

According to International Patent Classification (IPC) and Dutch national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
GOIV G08B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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

See patent family annex

1. Special categories cited documents
   A: document defining the general state of the art which is not considered to be of particular relevance
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   A: document member of the same patent family

Date of the actual completion of the international search: 11 December 2007

Date of mailing of the international search report: 19/12/2007

Name and mailing address of the ISA/ European Patent Office, P B 5818 Patentlaan 2 NL - 2280 HV RIJSWijk Tel (+31-70) 340-2040, Tx 31 651 epc nl, Fax (+31-70) 340-3016

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Trique, Michael
**INTERNATIONAL SEARCH REPORT**

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