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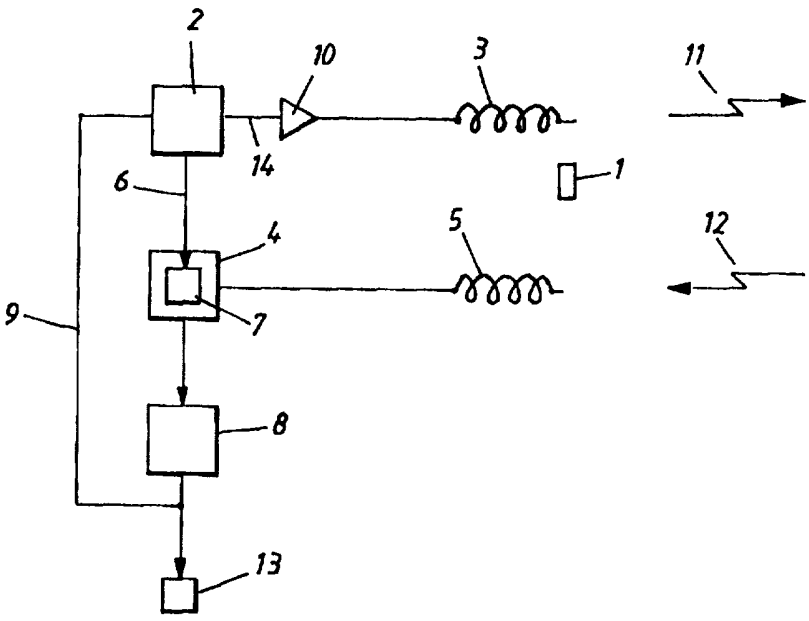
(57) Abstract

An arrangement pertaining to electronic alarm systems of the kind used in goods monitoring systems includes an alarm element (1) that is adapted to receive a magnetic alternating field which is transmitted from a transmitter (2) by means of a transmitter coil (3) and whose frequency is swept, wherein the alarm element is adapted to retransmit a magnetic alternating field, and wherein a receiver (4) that includes a receiver coil (5) is adapted to receive and detect the retransmitted alternating field. The invention is characterized in that the system transmitter (2) is adapted for variation of the transmitted frequency; in that the system receiver (4) is adapted to receive and detect the occurrence of a signal from a disturbing other system; in that there is provided a control circuit (8) which is adapted to analyze the frequency and phase position of a signal transmitted from a disturbing system in relation to the frequency and phase position of the alternating field transmitted from the first system; and in that the control circuit (8) is adapted to deliver to the transmitter (2) of the first-mentioned system a control signal that displaces the transmitted frequency so that the first system is not disturbed by the disturbing signal.



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AN ARRANGEMENT RELATING TO ELECTRONIC ALARM SYSTEMS THAT DELIVER CONTROL SIGNALS SUCH AS TO DISPLACE THE SYSTEM TRANSMISSION FREQUENCY AND THEREWITH AVOID DISTURBANCES

The present invention relates to an arrangement pertaining to electronic alarm systems of the kind used in goods monitoring systems.

Many different types of goods monitoring alarm systems are described in the patent literature. These systems are intended to prevent the removal of unpaid goods from stores and like shopping facilities. These alarm systems normally include some sort of alarm element that is fastened to the goods to be protected, and detection means that are permanently installed at store exits and that generate an alarm with the aid of remote sensors when goods carrying an alarm element are brought into the proximity of the store exit.

Remote sensing is normally achieved by generating an alternating magnetic field in which the presence of an alarm element can be detected as a result of a change in the alternating field that is characteristic of the alarm element.

The alarm element may have the form of a long, narrow and thin strip of highly permeable material whose characteristic property is found in the transmission of high order harmonics when exposed to a magnetic alternating field. This known basic principle enables the presence of narrow and inexpensive alarm elements to be detected with the aid of complicated and relatively expensive detection devices. This type of alarm system is particularly suited for use in daily shopping complexes and is described in European Patent Specification EP 0 153 286, among others.

Known alarm elements can also consist of a simple electric resonance circuit. The detector arrangement can therewith be made relatively simple and inexpensive, provided that the coil in the resonance circuit is made relatively large and that a relatively good Q-value can be easily obtained together with a large coupling to an external field. In this regard, the coil is placed in an alarm plate which is fastened to the goods to be protected, with the aid of some kind of locking device.

Such alarm systems may be constructed in a manner in which the detector arrangement includes two mutually spaced alarm arched coils that delimit the sensing zone. Several such alarm arches may be placed parallel with one another so as to form two or more parallel sensing zones.

When large departmental stores and like service complexes include two or more mutually independent alarm systems of the kind that transmit on essentially the same frequency and that are set to detect the occurrence of approximately the same frequency resulting from the presence of an alarm element, the mutually independent alarm systems are liable to interfere with one another by virtue of the fact that the transmitted alternating fields give rise to frequency differences that correspond to the frequency or frequencies to be detected by the system, thereby resulting in over-driving of the amplifiers in the detectors due to the strength of the signal greatly exceeding the strength of a signal that originates from an alarm element. This makes it impossible to detect the presence of an alarm element.

One known method of solving this problem is to synchronize the fields transmitted from the various systems so that the fields will be transmitted synchronously, by drawing cables between the different systems so as to synchronize the transmitters.

The different systems can also be synchronized by allowing each system to operate intermittently over short time intervals and to activate the systems successively so that only one system will operate at any one time. Synchronization of the systems is effected by means of a cable connection also in this case.

Departmental stores and shopping centres often have a multiple of systems that are located at relatively short distances from each other and that belong to different owners. Furthermore, new systems are installed and systems are moved.

Consequently, the problem solution achieved by cable connections can only be applied in practice in the case of a few systems and when the systems can be mutually coordinated, for instance when the systems have only one owner.

Accordingly, the present invention relates to an arrangement pertaining to electronic alarm systems of the kind used in goods monitoring systems, wherein the system includes an alarm element which is adapted to receive a magnetic alternating field that is transmitted from a transmitter by means of a transmitter coil and the frequency of which is swept, wherein the alarm element is adapted to retransmit a magnetic alternating field, wherein a receiver that includes a receiver coil is adapted to receive and detect the retransmitted alternating field, wherein the electronic alarm system is characterized in that the system transmitter is adapted to vary the transmitted frequency; wherein the system receiver is adapted to receive and detect the presence of a signal deriving from a disturbing other system; wherein the system includes a control circuit that analyzes the frequency and phase position of a signal transmitted from a disturbing system relative to the frequency and phase position of the alternating field transmitted from the first-mentioned system; and wherein the control circuit is adapted to deliver a control signal to the

transmitter of the first-mentioned system such as to displace its sweeping frequency and therewith prevent disturbance of the first-mentioned system by the disturbing signal.

The invention will now be described in more detail with reference to an exemplifying embodiment thereof and also with reference to the accompanying drawing, in which

- Figure 1 is a block schematic illustrating an inventive arrangement.

The present invention relates to an arrangement pertaining to electronic alarm systems of the kind used in goods monitoring systems.

Such a system includes a known alarm element 1 that is adapted to receive a magnetic alternating field transmitted from a transmitter 2 by means of a transmitter coil 3. The frequency of the transmitted alternating field is swept. For instance, there is transmitted an alternating field having a frequency of 8.2 MHz +/- 0.5 MHz. The alarm element 1 is adapted to retransmit a magnetic alternating field. A receiver 4 that includes a receiver coil 5 is adapted to receive and detect the retransmitted alternating field. To this end, the transmitter 2 delivers the transmitted signal to the receiver 4 via a conductor 6 and the received signal is down-mixed in a known manner.

Depending on the type of alarm element used, i.e. the type of retransmitted field generated by the alarm element, the system will include adapted circuits for the detection of the signal received by the receiver with respect to fields that are generated by an alarm element. It can be said generally that known alarm elements retransmit a field periodically, i.e. at given time intervals contingent on the periodically sweeping field transmit-

ted by the transmitter, thereby enabling the occurrence of such a periodically occurring signal to be detected. The arrangement triggers an alarm signal when an alarm element is located in the monitoring zone.

According to the invention, the system transmitter 2 is designed to be able to vary the transmitted frequency, i.e. the centre frequency about which the field sweeps. The frequency at which the transmitted frequency sweeps is preferably synchronized with the frequency of the transmitted signal. This can be achieved, for instance, by generating the sweeping frequency by dividing the frequency 14 generated by the transmitter and applied to the amplifier 10. This causes the centre frequency to control the sweep frequency.

The system receiver 4 is adapted to receive and to detect the occurrence of a signal from a disturbing other system. There is provided to this end a control circuit 8 which functions to analyze the frequency and phase position of a signal transmitted from a disturbing system in relation to the frequency and phase position of the alternating field transmitted from the first-mentioned system. The disturbing system may be a system of the same kind as the inventive system or of a kind different thereto.

The transmitted frequency of the disturbing system will interfere with the present system when the frequency lies so close to the transmitted frequency of the inventive system that reception of the disturbing frequency will cause the receiver amplifier to be over-driven and thereby prevent detection of an alarm system.

Detection of the disturbing frequency can be effected by including a quadrature detector 7 in the receiver. The signals generated in the quadrature detector can be delivered to a known control

circuit 8 which functions to analyze the frequency and phase position of the received signal.

According to the invention, the control circuit 8 also functions to deliver a control signal to the transmitter 2 of the first system and to displace the sweeping frequency of said transmitter so as to prevent the disturbing signal from disturbing the first-mentioned system.

According to a first embodiment of the invention, the control circuit 8 is adapted to deliver a control signal 9 to the transmitter 2 of the inventive system so as to cause the transmitter to transmit a frequency sweeping alternating field whose frequency and phase position coincide with the disturbing signal received at each moment in time.

The control circuit is suitably adapted to change the transmitted frequency so as to bring said frequency successively closer to the disturbing frequency.

Thus, the inventive system will adapt itself to transmit a field that is fully synchronous with the disturbing field.

In Figure 1, the arrow 11 indicates the field transmitted by the inventive system and the arrow 12 indicates the disturbing signal.

Thus, when two systems of the present kind are installed, both systems will individually adjust their phase position and frequency in accordance with the respective disturbing signal. The two systems will thus finally transmit a frequency that lies somewhere between the original frequencies. It will be understood that three or more mutually disturbing systems will also approach one another until they transmit on the same frequency.

Thus, all coordination systems are effected in a wireless fashion.

According to a second embodiment of the invention, the control circuit 8 is adapted to deliver to the transmitter 2 of the first-mentioned system a control signal which displaces its sweeping frequency so that said frequency will differ from the sweeping frequency of the disturbing signal by a difference frequency that is greater than the bandwidth of the signal that the first-mentioned system is intended to receive.

According to this second embodiment, the control circuit is conveniently adapted to change the transmitted frequency so as to bring said frequency successively closer to the disturbing frequency.

This second embodiment of the invention thus also causes the frequencies of two or more mutually disturbing systems to be displaced so that the systems will no longer disturb one another.

Thus, when the different systems transmit frequencies that do not disturb one another at a given time point, one of the systems may be driven slowly in frequency so that the driving system will begin to disturb another system after a given period of time. In this case, the respective control circuit of the mutually disturbing system may be adapted to displace respective frequencies directly upon the occurrence of disturbance, so that said disturbance will no longer occur.

According to one highly advantageous embodiment of the invention, the transmitter 2 includes a digital direct synthesis circuit to which the control signal 9 is delivered. The digital circuit is adapted to generate digitally the frequency and its sweep to be transmitted. The digital circuit is also adapted to transmit the

frequency and its sweep in a phase position given by the control signal. Such digital synthesis circuits, or chips, are known and commercially available, as is also the simple logic required to effect a sweep that is correlated to the centre frequency. This can be achieved, for instance, with the aid of the clock that controls the digital direct synthesis circuit also counting in a frequency counter that controls the frequency generated by the digital direct synthesis circuit. The signal generated by the digital direct synthesis circuit is thus amplified in an amplifier 10 and transmitted via the coil 3.

According to one preferred embodiment of the invention, the control circuit 8 includes a microprocessor that is adapted to carry out said analysis, preferably by means of a Fourier analysis and adapted to generate said control signal.

The frequency and phase position of a disturbing signal can be analyzed by a Fourier analysis.

The control circuit 8 is conveniently adapted to activate an alarm device 13 when the presence of an alarm element is detected.

According to one embodiment, the digital direct synthesis circuit is constructed to enable the frequency of its internal oscillator to be influenced by the control signal. This enables the frequency setting to be finely adjusted by slightly displacing the frequency of the internal oscillator, therewith displacing correspondingly the frequency generated by the digital direct synthesis circuit.

The control signal may, however, contain information that causes the digital direct synthesis circuit to generate the desired

frequency while retaining the frequency of the internal oscillator.

It will be evident that the problems mentioned in the introduction are solved by means of the present invention, wherewith the systems become self-adjusting in relation to one another.

Although the invention has been described with reference to various embodiments thereof, it will be obvious that these embodiments can be modified in many different ways. For instance, detection can be effected in ways other than with the aid of a quadrature detector.

The invention is therefore not restricted to the afore-described exemplifying embodiments, since modifications and variations can be made within the scope of the following Claims.

CLAIMS

1. An arrangement pertaining to electronic alarm systems of the kind used in goods monitoring systems, wherein the alarm system includes an alarm element (1) that is adapted to receive a magnetic alternating field which is transmitted from a transmitter (2) by means of a transmitter coil (3) and whose frequency is swept, and wherein the alarm element is adapted to retransmit a magnetic alternating field, and wherein a receiver (4) that includes a receiver coil (5) is adapted to receive and detect the retransmitted alternating field, **characterized** in that the system transmitter (2) is adapted for variation of the transmitted frequency; in that the system receiver (4) is adapted to receive and detect the occurrence of a signal from a disturbing other system; in that there is provided a control circuit (8) which is adapted to analyze the frequency and phase position of a signal transmitted from a disturbing system in relation to the frequency and phase position of the alternating field transmitted from the first system; and in that the control circuit (8) is adapted to deliver to the transmitter (2) of the first-mentioned system a control signal which displaces the transmitted frequency so that the first system is not disturbed by the disturbing signal.

2. An arrangement according to Claim 1, **characterized** in that the control circuit (8) is adapted to send to the transmitter (2) of the first-mentioned system a control signal that displaces the transmitted frequency and causes the transmitter (2) to transmit an alternating field whose frequency and phase position coincide with the frequency and phase position of the received disturbing signal.

3. An arrangement according to Claim 1, **characterized** in that the control circuit (8) is adapted to send to the transmitter (2) of the first-mentioned system a control signal that displaces the

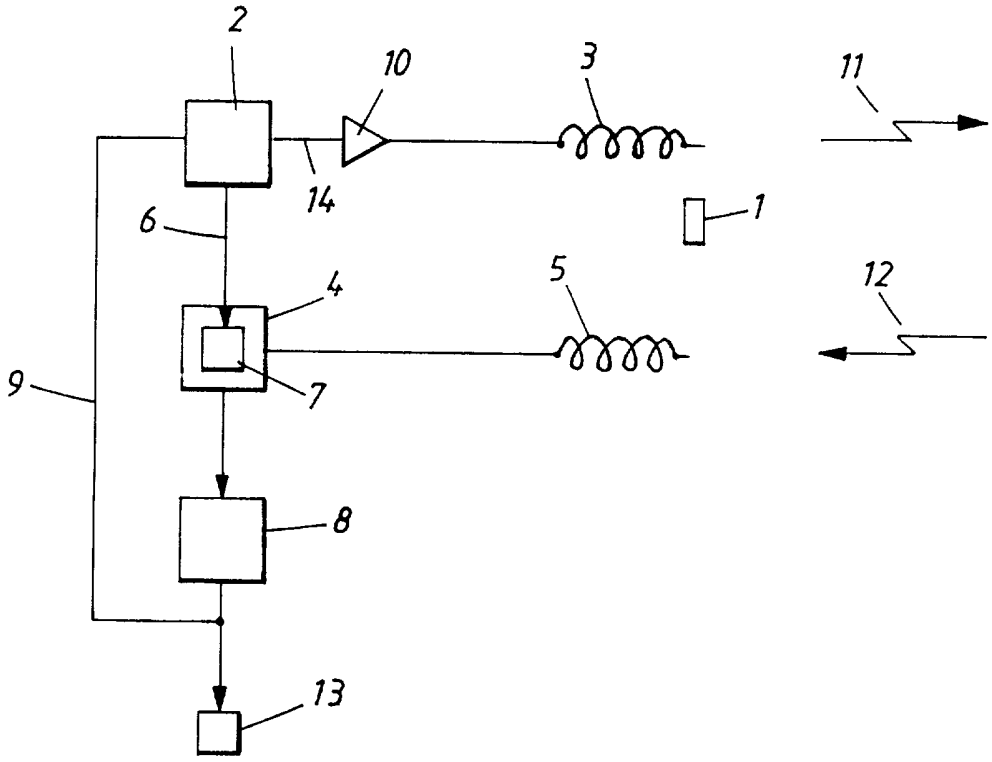
transmitted frequency so that said frequency differs from the sweeping frequency of the disturbing signal by a difference frequency that is greater than the bandwidth of the signal that the first-mentioned system is intended to receive.

4. An arrangement according to Claim 1, 2 or 3, **characterized** in that the transmitter (2) includes a digital direct synthesis circuit to which the control signal is delivered, said digital circuit being adapted to digitally generate the frequency to be transmitted.

5. An arrangement according to Claim 1, 2, 3 or 4, **characterized** in that the control circuit (8) includes a microprocessor which functions to carry out said analysis, preferably by means of a Fourier analysis; and in that the microprocessor is adapted to generate said control signal.

6. An arrangement according to Claim 4 or Claim 5, **characterized** in that the digital direct synthesis circuit is designed so that its internal oscillator frequency can be influenced by said control signal.

Fig. 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00861

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G08B 13/24
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)

IPC6: G08B

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

SE,DK,FI,NO classes as above

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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.
A	EP 0226402 A2 (MINNESOTA MINING AND MANUFACTURING COMPANY), 24 June 1987 (24.06.87), column 2, line 3 - column 3, line 36 --	1-6
A	US 5371490 A (M. MARTINIDES), 6 December 1994 (06.12.94), column 2, line 12 - line 52 --	1-6
A	US 5023600 A (C.R. SZKLANY ET AL.), 11 June 1991 (11.06.91), column 2, line 3 - column 3, line 26 -- --------	1-6

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

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0226402 A2	24/06/87	CA 1260106 A	26/09/89
		DE 3688047 A	22/04/93
		JP 8021144 B	04/03/96
		JP 62135997 A	18/06/87
		US 4667185 A	19/05/87
US 5371490 A	06/12/94	CH 681051 A	31/12/92
		EP 0388609 A	26/09/90
		JP 2284294 A	21/11/90
US 5023600 A	11/06/91	NONE	