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Sugiura

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[54] **DISCRIMINATIVE INTRUDER-DETECTING SYSTEM**

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[51] **Int. Cl.** **G08b 13/00**

[58] **Field of Search** ..... 340/258 B, 258 R, 276, 340/280; 343/18 D, 18 E, 7 A, 7.7, 6.5 SS, 6.5 R; 325/8

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[57] **ABSTRACT**

A discriminative intruder-detecting system includes a transceiver unit and a modulator unit both of which are completely separate from and unconnected to each other. The transceiver unit has an oscillator and antenna which cooperate to transmit waves of radio frequency through the space which is to be guarded. The modulator unit has a dipole antenna provided with a pair of feed points to which a low-frequency oscillator is connected for introducing low-frequency components to the dipole antenna, this latter antenna resonating at the frequency of the waves transmitted by the antenna of the transceiver unit. Waves reflected by the dipole antenna back to the antenna of the transceiver unit will thus contain low-frequency components, and the circuitry of the transceiver unit is capable of preventing operation of a warning device when the reflected waves with the low-frequency components are received. Thus, an authorized individual carrying the modulator unit on his person and entering the guarded space will not set off the warning device while an unauthorized individual will reflect waves without low-frequency components back to the antenna of the transceiver unit so as to cause the warning device to operate.

8 Claims, 2 Drawing Figures

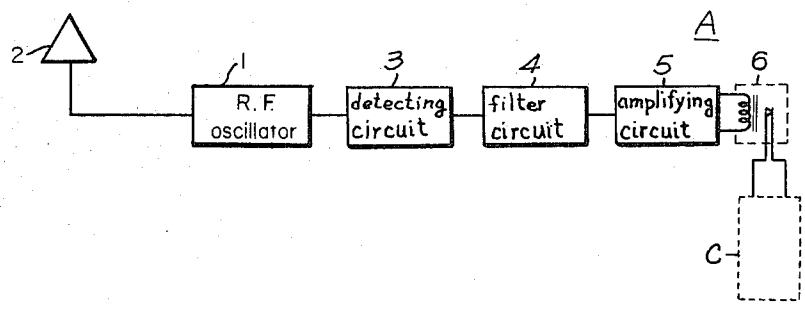


fig - 1

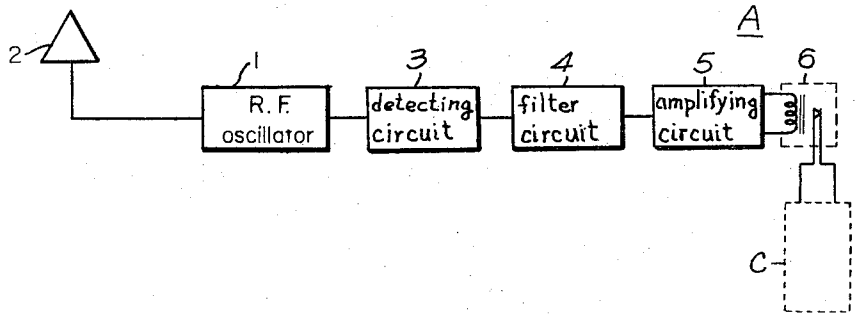
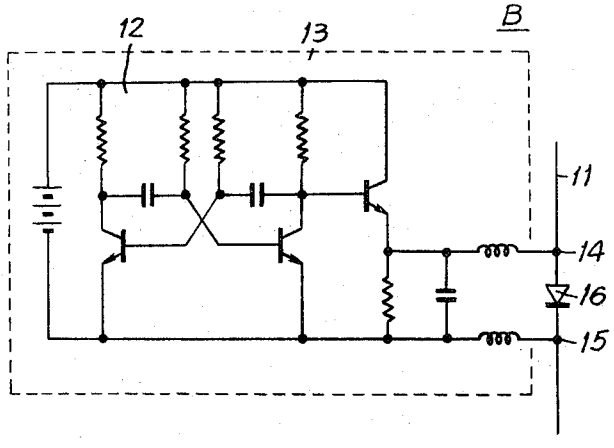

A
2
1
R. F. oscillator
3
detecting circuit
4
filter circuit
5
amplifying circuit
6
C

fig - 2


B
12
13
11
14
16
15

DISCRIMINATIVE INTRUDER-DETECTING SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to systems for detecting the presence of intruders in a space to which the intruders have gained unauthorized entry.

Systems of this latter type are known and are conventionally constructed in a number of different ways. For example, one type of system utilizes an ultrasonic wave, another type utilizes a visible light, and a third type utilizes a radio wave. In general, all of these types of detector systems are designed so that they will give a warning signal at any time when any person enters the space which is guarded by the system.

However, these known systems suffer from certain inconveniences. For example, it is not uncommon to install such systems in rooms or other spaces where authorized individuals can freely enter, and one of the major drawbacks of the conventional systems is that they will unavoidably give a warning even when an authorized individual who is not an intruder enters the space which is guarded.

Another problem which is encountered with conventional systems is that they respond undesirably to Doppler-frequency signals so that undesirable controls are initiated by such signals.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide a system which will avoid the above drawbacks.

In particular, it is an object of the present invention to provide a system which is capable of reliably guarding against intruders, by giving a warning when an intruder enters the guarded space, while at the same time being capable of preventing the warning device from being actuated when an authorized indivdual enters the space which is guarded with the system of the invention.

It is furthermore an object of the present invention to provide a system of this type which can utilize simple substantially conventional structure in connection with the unit which guards the space which is to be protected against intruders, while at the same time being capable of utilizing with such a substantially conventional system a further unit capable of being conveniently carried on the person of an authorized individual for preventing the warning device from being actuated when an authorized individual is in the guarded space.

In addition, it is an object of the present invention to provide a system of this type which will reliably prevent undesirable controls from being initiated in response to Doppler-frequency signals.

In accordance with the invention there is provided a discriminative intruder-detecting system which includes a radio transceiver unit adapted to be placed within a space which is to be guarded so as to remain stationary in this space. The transceiver unit includes a radio-frequency oscillator means for generating an oscillation output of radio frequency and an antenna means which is operatively connected with the oscillator means for transmitting through the space which is to be guarded radio waves at the frequency determined by the oscillator means. A warning means is provided

for giving a warning signal which indicates the presence of an intruder in the guarded space. An electrical circuit means forms part of the transceiver unit and electrically connects the warning means to the transceiver unit for actuating the warning means in response to radio waves reflected from an intruder in the space and received by the antenna means. A modulator unit is separate from and has no connection with the transceiver unit, this modulator unit being adapted to be carried on the person of an individual who is authorized to enter the guarded space. The modulator unit includes a modulating antenna means which resonates at the radio frequency of the wave transmitted by the antenna means of the transceiver unit. This modulator unit includes a means which is operatively connected to the modulator antenna means for introducing a low-frequency component into the wave reflected by the modulator antenna means back to the antenna means of the transceiver unit. Thus, waves received by the antenna means of the transceiver unit from an authorized individual in the guarded space who carries the modulator unit will include a low-frequency component. The circuit means which electrically connects the warning means to the transceiver unit includes a detecting circuit means for detecting the presence of the waves received from the modulator antenna means with the low-frequency component and for preventing actuation of the warning means when the waves with the low-frequency component are received by the antenna means of the transceiver unit.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. **1** is a schematic diagram illustrating a transceiver unit and warning device used in the system of the invention; and

FIG. **2** is a wiring diagram of a modulator unit of the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, the discriminative intruder-detecting system of the invention includes a transceiver unit which is illustrated in FIG. **1.** The transceiver unit A shown in FIG. **1** is adapted to cooperate in the manner described below with a modulator unit B shown in FIG. **2,** this latter unit B being separate from and having no connection with the transceiver unit A. These units A and B cooperate with each other in such a way that a warning signal is not given by the warning means C shown at the right end of FIG. **1** when a person carrying the modulator B enters the space which is guarded by the transceiver unit A.

This transceiver unit A illustrated in FIG. **1** is of a type which is adapted to actuate the warning means C which is electrically connected to the remainder of the transceiver unit A through the illustrated circuitry. This circuitry includes a radio-frequency oscillator means **1** of conventional construction which is capable of oscillating at radio frequency (for example, at several G Hz). The oscillation output of the radio-frequency oscillator means **1** is transmitted from a fixed antenna means **2** carried by the transceiver unit A, this antenna means **2** being electrically connected with the oscillator means **1** and transmitting the waves of radio frequency

throughout the space which is to be guarded when the unit A is installed in and remains stationary in the latter space. The warning means C is located also in this space and is electrically connected to the transceiver unit A in the manner shown schematically in FIG. **1.**

The modulator unit B which is illustrated in FIG. **2** is a portable unit of relatively small size which can conveniently be carried on the person of an authorized individual in a pocket, for example. This unit B is completely separate from and has no connection with the unit A, as pointed out above. Thus, this unit B also has no connection with the warning means C. The construction of the modulator unit B is such that it will cooperate with the transceiver unit A. This modulator unit B has a modulator antenna means **11** which resonates at the specific radio frequency of the waves transmitted by the stationary antenna means **2.** The modulator antenna means **11** is in the form of a half-wave dipole antenna.

The modulator unit B further includes an astable circuit (astable multivibrator) **12** in the form of a low-frequency oscillator means **12** (this low-frequency oscillator means **13** including an amplifying circuit, etc.). This low-frequency oscillator means generates a low-frequency signal which is applied across the feed points **14** and **15** of the dipole antenna **11.** A directional means **16** is connected between these feed points **14** and **15** to which the low-frequency oscillator means is electrically connected. In the illustrated example this directional means takes the form of a semi-conductor diode. Thus, because of the presence of this directional means **16,** the dipole antenna **11** will be electrically disconnected in an intermittent manner by way of the low-frequency signals from the low-frequency oscillator means **13.** As a result, the wave transmitted from the antenna means **2** of the transceiver unit A is reflected from the dipole antenna **11** while being modulated with a frequency at which the dipole antenna **11** is intermittently disconnected, this being the low-frequency oscillation generated by the low-frequency oscillator means **13,** and the result is that the modulator means B reflects back to the antenna means **2** a radio wave which has low-frequency components. Thus, the antenna means **11** resonates at the specific radio frequency of the wave transmitted from the antenna means **2** and reflects back to the latter antenna means a wave which has low-frequency components and which is received by the antenna means **2** and introduced into the transceiver unit A.

Thus, the transceiver unit A shown in FIG. **1** will receive the radio wave reflected back to the antenna means **2** from the antenna means **11** which contains the low-frequency components. The electrical circuit means which connects the warning means C to the transceiver unit A includes not only the oscillator means **1** and the antenna **2** but also the detecting circuit means **3.** This detecting circuit means **3** is capable of responding to the presence of the low-frequency component in the waves received from the modulator antenna means **11,** and with this circuitry the response of the detecting circuit means **3** to the presence of the low-frequency components will prevent the warning means C from being actuated. Thus, when the waves reflected back to the transceiver unit A contain the low-frequency components, the detecting circuit means **3** will operate to prevent the warning means C from being actuated, and thus no warning signal will be given in connection with the presence of an intruder in the guarded space. The output signal resulting from the received waves which are received by the transceiver unit A of FIG. **1** is forced to pass through a filter circuit **4** and is then amplified by way of the amplifying circuit **5** so as to actuate a relay **6** which is connected with the amplifying circuit **5** in order to control the warning device C by opening and closing contacts of the delay **6.**

Of course, in the event that an intruder is in the guarded space, the waves reflected from the intruder back to the antenna means **2** will not have the low-frequency components, and under these circumstances the detecting circuit means **3** will not prevent operation of the warning means C, so that the warning signal will be given.

Since the portable modulator unit B of the invention is carried about on a person who moves about in the guarded space, for example by walking around therein, this modulator unit B will necessarily move and there will thus be created the so-called Doppler-frequency signals at the transceiver unit A. It is also desirable to prevent the warning means C from being actuated by such Doppler-frequency signals. With the transceiver unit A which is shown in FIG. **1,** the Doppler-frequency signals are eliminated by means of the filter circuit means **4** which forms part of the electrical circuit means connecting the warning means C to the transceiver unit A. In order to enable these Doppler-frequency signals to be eliminated in an easy and fully reliable manner, the oscillation frequency of the low-frequency oscillator means **13** which forms part of the modulator unit B is selected so as to have a value which differs substantially from the Doppler-frequency, this difference being sufficient to enable the filter circuit means **4** to eliminate these signals and thus prevent undesirable actuation of the warning means C.

Thus, with the system of the invention, there will be no warning signal when authorized individuals, who carry the modulator unit B on their person, enter the space which is guarded by the transceiver unit A.

It is to be understood that the discriminative intruder-detecting system of the invention may be conveniently installed in a reception room or in a warehouse into which persons will enter only for a limited time. In other words, with the intruder-detecting system of the invention there will be no warning signal as, for example, when a guard enters the guarded space in order to inspect this space which is guarded by the system of the invention, as long as the guard carries on his person the modulator unit B of FIG. **2.**

What is claimed is:

1. In a discriminative intruder-detecting system, a radio transceiver unit adapted to be placed within a space which is to be guarded and to remain stationary in said space, said transceiver unit including a radio-frequency oscillator means for generating an oscillation output of radio frequency and antenna means operatively connected with said oscillator means for transmitting through the space which is to be guarded radio waves at the frequency determined by said oscillator means, warning means for providing a warning signal which indicates the presence of an intruder in said space, electrical circuit means forming part of said transceiver unit and electrically connecting said warning means to said transceiver unit for preventing acutuation of said warning means in response to radio

waves reflected from an authorized individual in said space and received by said antenna means, and a modulator unit separate from and having no connection with said transceiver unit, said modulator unit being adapted to be carried on the person of an indiviual who is authorized to enter the guarded space, said modulator unit including a modulating antenna means which resonates at the radio frequency of the wave transmitted by said antenna means of said transceiver unit, and said modulator unit including a means operatively connected to said modulating antenna means for introducing a low frequency component into the wave reflected by said modulating means back to said antenna means of said transceiver unit, so that waves received by the latter antenna from an authorized individual in said guarded space who carries said modulator unit will include a low-frequency component, and said circuit means which is electrically connected to said warning means including a detecting circuit means for detecting the presence of the waves received from said modulating antenna means with said low-frequency component and switch means for controlling said warning means such that when said waves with said low-frequency component are received by said antenna means of said transceiver unit said warning means will not be actuated.

2. The combination of claim **1** and wherein said modulating antenna means is a half-wave dipole antenna having a pair of feeding points, said means which is operatively connected to said dipole antenna for providing said low-frequency component including a low-frequency oscillator means connected to said points for generating a low-frequency signal across said points, and a directional means connected between said points for electrically disconnecting said dipole antenna intermittently in response to the low-frequency signals from said low-frequency oscillator means, so that a wave transmitted from said antenna of said transceiver unit and reflected by said dipole antenna is modulated with the frequency at which said dipole antenna is intermittently disconnected, to provide the reflected radio wave which contains said low-frequency components.

3. The combination of claim **2** and wherein said directional means is a semiconductor diode connected between said points of said dipole antenna.

4. The combination of claim **1** and wherein said circuit means which electrically connects said warning means to said transceiver unit includes a means for eliminating Doppler-frequency signals.

5. The combination of claim **4** and wherein said means for eliminating said Doppler-frequency signals includes a filter circuit means, and said means for introducing a low-frequency component including a low-frequency oscillator means which is electrically connected with said modulating antenna means and which has an oscillation frequency sufficiently different from the Doppler frequency to permit said filter circuit means to filter one frequency from the other.

6. The combination of claim **5** and wherein said low-frequency oscillator means of said modulator unit forms said means operatively connected to said modulating antenna means for introducing a low-frequency component into the wave reflected thereby back to said antenna means of said transceiver unit, said modulating antenna means includes a half wave dipole antenna having a pair of feed points to which said low-frequency oscillator means is electrically connected.

7. The combination of claim **6** and wherein said modulator unit includes a directional means connected between said feed points for electrically disconnecting said dipole antenna intermittently in response to the low-frequency signals from said low-frequency oscillator means.

8. The combination of claim **7** and wherein said directional means is a semiconductor diode connected between said points of said dipole antenna.

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