

Dec. 1, 1970

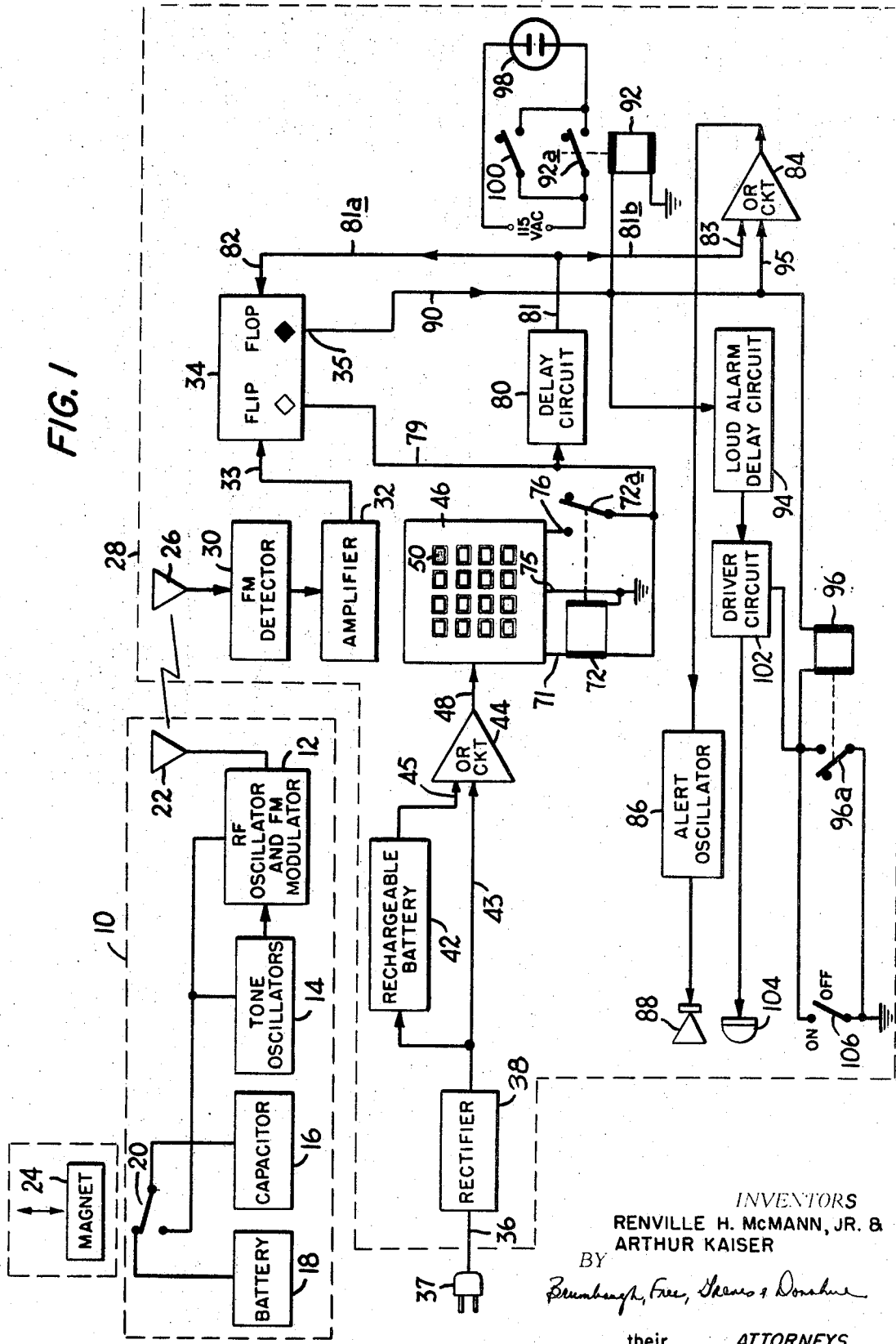
R. H. McMANN, JR., ET AL

3,544,987

PROPERTY PROTECTION ALARM SYSTEM

Filed Feb. 24, 1967

2 Sheets-Sheet 1



INVENTORS
RENNIE H. McMANN, JR. &
ARTHUR KAISER

BY

Bloomington, Free, Skene & Donahue

their ATTORNEYS

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2 Sheets-Sheet 2

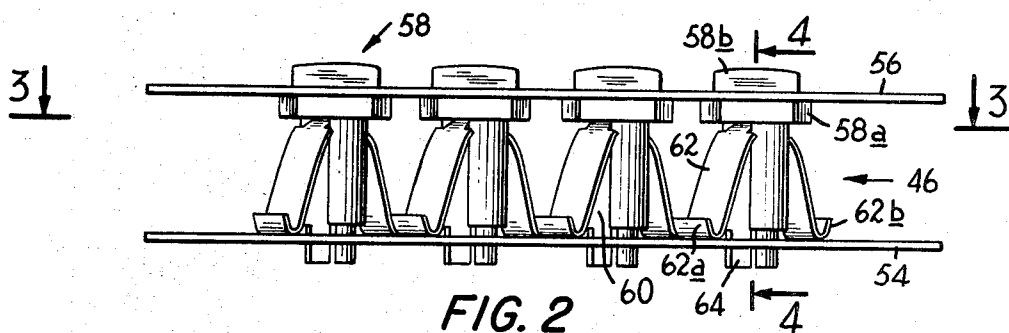


FIG. 2

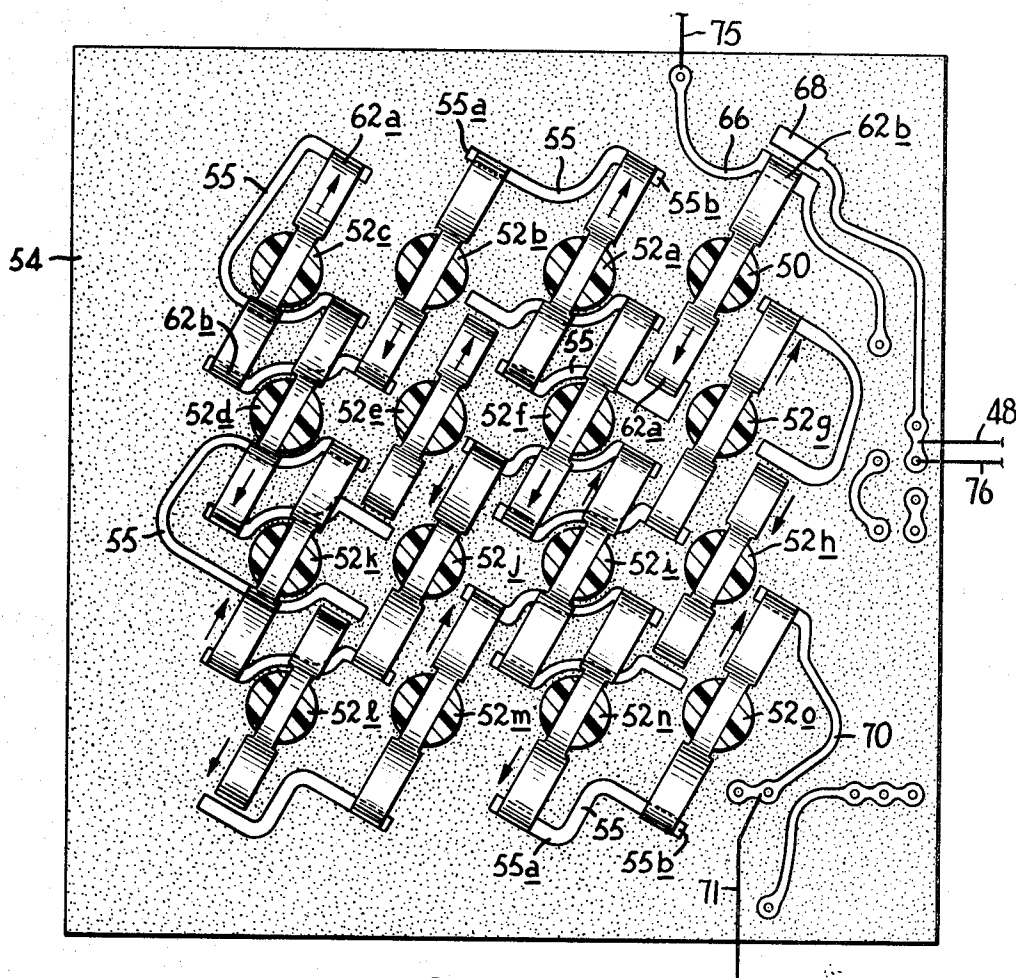


FIG. 3

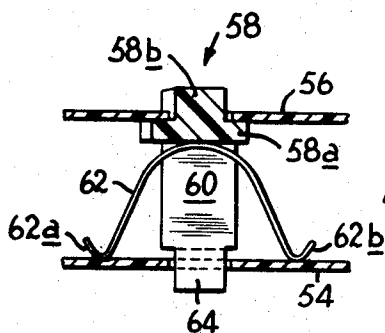


FIG. 4

INVENTORS
RENVILLE H. McMANN, JR. &
ARTHUR KAISER

BY

Brennhaugh, Free, Graves & Donohue

their ATTORNEYS

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3,544,987

PROPERTY PROTECTION ALARM SYSTEM

Renville H. McMann, Jr., New Canaan, and Arthur Kaiser, Trumbull, Conn., assignors, by direct and mesne assignments, of one-half to Columbia Broadcasting System, Inc., New York, N.Y., a corporation of New York, and one-half to Pinkerton, Inc., New York, N.Y., a corporation of Delaware

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10 Claims

ABSTRACT OF THE DISCLOSURE

In the particular embodiment of the invention a centrally located radio receiver detects a signal from a transmitter located at each entry to a building whenever the entry is opened. Reception of the signal normally initiates an alarm but, to permit authorized entry, the alarm may be delayed. Entering the proper code into a keyboard-operated delay unit enables the system and similarly disables it.

BACKGROUND OF THE INVENTION

This invention relates to alarm systems and, more particularly, to property protection alarm systems, such as, for example, fire alarm systems, burglar entry alarm systems and the like.

Most property protection alarm systems are remote control alarm systems which include an alarm detector and an alarm indicator, the detector supplying a signal to the indicator whenever an unsafe condition exists, such as, for example, excessive heat, an unauthorized entry and the like. The indicator, in response to the signal generated by the detector, supplies either a visual or an audio alarm indication. Heretofore, many such alarm systems could not be expanded without altering the entire system and the electronic and mechanical requirements thereof. With burglar alarm systems, one disadvantage is that an alarm will be sounded even if an authorized entry takes place. Still another disadvantage is that an intruder may easily deactivate the alarm indicator once he has entered the protected building.

Accordingly, it is an object of the present invention to provide a property protection alarm system which overcomes all the above-mentioned disadvantages of the prior art.

It is another object of the present invention to provide a new and improved property protection alarm system which is modular in design and is easily expandable for incorporation of additional detector units.

SUMMARY OF THE INVENTION

These and other objects of the invention are accomplished by providing a property protection alarm system comprising at least one sensor unit for disposition at each area to be protected, each of the sensor units being a self-contained signal transmitter adapted to transmit a signal whenever an unsafe condition exists in that area, and a receiver unit disposed at a remote point and responsive to the signal transmitted by the sensor unit for initially generating an alert alarm and for thereafter generating a loud alarm. Included within the receiver is a unit for resetting the receiver unit both before and after receipt of a signal indicating the existence of an unsafe condition.

In one embodiment of the invention, wherein a sensor unit is located at an access opening in the building to be protected, a magnet is fixed to the movable element of the access opening, and each sensor unit includes a self-

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contained radio transmitter having a reed switch responsive to the movement of the magnet for activating the transmitter, which then generates an RF carrier signal frequency modulated with an audio signal. The receiver unit comprises a detector for demodulating the transmitted RF signal, a bistable device for driving an alert alarm indicator and a delay circuit for driving a loud alarm indicator a selected period of time after the alert alarm is given.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a schematic block diagram of a typical burglar alarm system arranged according to the invention;

FIG. 2 is a view in perspective of the manual keyboard of FIG. 1;

FIG. 3 is a cross-sectional view of the manual keyboard taken along line 3—3 of FIG. 2 and looking in the direction of the arrows; and

FIG. 4 is a view in cross-section of a switch on the keyboard taken along line 4—4 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In a representative embodiment of the present invention, as shown in FIG. 1, a burglar alarm system is provided which includes a plurality of sensor devices 10 which are disposed at various access openings in the building to be protected. Each sensor device includes an RF oscillator and FM modulator 12 operating in the FM broadcasting frequency band (88–108 mc.) and high audio frequency oscillators 14 for supplying tone signals to modulate the RF carrier signal generated by the oscillator 12. Power for the oscillators 12 and 14 is supplied from a capacitor 16 which is maintained fully charged by a battery 18, the battery being normally coupled to the capacitor 16 through a two-position reed switch 20. In its other position, the reed switch 20 disconnects the capacitor from the battery 18 and couples the capacitor to the tone and RF oscillator circuits 14 and 12, respectively, to cause the latter to generate a burst of RF signal frequency modulated with the audio tone signals. This frequency modulated signal is then radiated as an electromagnetic wave by an antenna 22.

The two-position reed switch of the sensor device 10 is operated by a magnet 24 which is fixed to a movable element at the access opening, such as, for example, a door or window. As long as the movable element remains fixed, the arm of the switch 20 is pulled to the position shown so that the battery 18 is connected in charging relationship with the capacitor 16. If the door or window is opened by a small amount, such as, for example, one-quarter of an inch, the switch 20 is released to its normally closed position and connects the fully charged capacitor 16 to the RF and tone oscillator circuits 12 and 14, respectively, the oscillator 12 generating a burst of RF signal modulated with the tone signals. It should be noted that by maintaining the battery 18 normally coupled to the capacitor 16, the operational life span of the device is increased because power is not constantly drained from the battery. The overall size of the sensor device 10 is small enough to be inconspicuously mounted adjacent the frame of the door or window and the magnet 24 itself may be readily concealed in the door or sash. In one successfully operated embodiment, the total volume occupied by the device 10 was approximately one cubic inch.

An electromagnetic wave radiated by the antenna 22 of any one of the devices 10 is received by the antenna 26 of a receiver unit 28, indicated by the dashed lines, and supplied as a frequency modulated carrier signal to an FM detector 30. The FM detector, which may be of

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conventional construction, initially converts the constant amplitude FM signal into a signal in which the RF envelope varies in amplitude in accordance with the amplitude of the modulating tone signals and then recovers the tone signals from the modulation carrier signal. Coupled to the output terminal of the detector 30 is a frequency selective amplifier 32 which amplifies only the tone signals and supplies a signal to the set input terminal 33 of a bistable device 34, here shown as a conventional flip-flop. If the flip-flop 34 were in the reset condition, the amplified tone signal would trigger the flop into a set or "1" state and a constant voltage signal, such as, for example, 12.5 or 15 volts, would appear at the output terminal 35 of the flip-flop 34.

A power cable 36 terminated at one end by a plug 37 supplies 115 volt 60 cycle power signal from a wall socket (not shown) to the receiver 28. A rectifier 38, of conventional construction, rectifies the power signal and supplies a D-C power signal to a rechargeable battery 42 and to one input terminal 43 of an OR circuit 44, the other input terminal 45 of the OR circuit 44 being coupled to the output terminal of the rechargeable battery 42. The OR circuit 44, which may be of conventional construction, supplies an output voltage whenever a voltage of proper amplitude is supplied to either or both input terminals. Accordingly, the OR circuit 44 supplies an output voltage as long as the plug 37 is coupled to a source of A-C power or as long as the battery 42 retains its charge. The rationale behind the continual charging of the battery 42 is that the receiver will continue to operate even if the plug 37 is removed from the wall socket and even if there is a general power failure.

The D-C voltage transmitted by the OR circuit 44 is then applied to a coded switching means comprising a manual keyboard 46 through a conductor 48. As best shown in FIGS. 2, 3 and 4, the keyboard 46 comprises a start pushbutton switch 50, twelve normally closed switches 52a, 52b, 52c, 52d, 52f, 52g, 52i, 52j, 52k, 52m, 52n and 52o and three normally open switches 52e, 52h and 52l. The switches are mounted between a printed circuit board 54 having conductive elements 55 for coupling the pushbutton switches of the keyboard in series, and an upper plate 56 each conductive element including two land or contact areas 55a and 55b. The printed circuit board 54 and the upper plate 56 are attached by stanchions (not shown).

Each of the pushbutton switches includes a button member 58, having a portion 58a engaging the bottom edge of the upper plate 56 and a generally rectangular portion 58b extending through a corresponding circular opening formed in the upper plate 56. Below the plate 56, each switch includes a central cylindrical member 60, having a slotted portion for receiving a U-shaped spring member 62, and a lower cylindrical member 64 extending through a corresponding opening formed in the printed circuit board 54. It is noticeable that the switches are maintained in alignment by the suitable (rectangular) shaping of the portion 58b of the button member with respect to the corresponding opening formed in the upper plate 5a and that the travel of the switches in the vertical direction is limited by the cylindrical member 60 and the portion 58a of the button 58.

The spring member 62, including smooth end portions 62a and 62b, is disposed between the plate 56 and the board 54 such that the end portions 62a and 62b make or are capable of making contact with the land areas of adjacent conductive elements 55. For a normally closed pushbutton switch, the spring member 62 is sized such that the distance between the smooth ends 62a and 62b equals the distance between corresponding contact areas of adjacent conductive elements 55 and therefore engages those contact areas. When a normally closed pushbutton switch is depressed, the ends 62a and 62b will be displaced from the land areas of adjacent conductive elements to thereby break the electrical connection therebetween. For

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a normally open pushbutton switch, the distance between the opposite ends 62a and 62b of the spring member 62 is less than the distance between the land areas of adjacent conductive elements 55 and an electrical connection between adjacent conductive elements is made only by depressing the pushbutton switch.

As best shown in FIG. 3, the spring member of the start pushbutton switch 50 is normally in contact with the land area of a conductive element 55 and a first input conductive element 66. The land area of the conductive element 55 in contact with the end portion 62a is enlarged such that contact will be made between the end portion 62a and the land area even when the start pushbutton switch 50 is depressed. The land area of the input conductive element 66 normally in contact with the end portion 62b is of conventional size such that the end portion 62b is displaced from the land area of the input conductive element 66 and moved into contact with the land area of a second input conductive element 68 when the start pushbutton switch 50 is depressed. Accordingly, the start pushbutton switch is a single pole, double-throw switch.

The D-C power voltage transmitted by the OR circuit 44 is supplied through the conductor 48 to the second input conductive element 68 of the printed circuit board 54. When the start pushbutton switch 50 and the pushbutton switches 52e, 52h and 52l are simultaneously depressed, the D-C voltage is coupled through the printed conductive elements 55 and the spring members of all the switches, in the direction indicated by the arrows in FIG. 3, to the output conductive element 70. The conductive element 70 is coupled through a conductor 71 to the coil of a holding relay 72 (FIG. 1). The first input conductive element 66 of the printed circuit board 54 is coupled through a conductor 75 to circuit ground and to the output terminal of the relay 72.

The second input terminal 68 of the keyboard 46 is also coupled through a conductor 76 to the normally open terminal of a contact 72a associated with the relay 72. Thus, when the relay 72 is energized, the contact 72a continues to supply power voltage to hold the relay 72 energized after the pushbutton switches of the keyboard 46 are released. The movable arm of the contact 72a is connected through a conductor 79 to the flip-flop 34 and supplies power voltage to the flip-flop when actuated. The arm 72a is also connected to the input terminal of the delay circuit 80.

In response to the application of the D-C power signal to its input terminal, the delay circuit 80 generates a pulse having a predetermined amplitude and pulse width, such as, for example, a pulse having an amplitude of 15 volts and a pulse width of 20 seconds. Through a conductor 81 and branch conductors 81a and 81b, this pulse is supplied to the reset terminal 82 of the flip-flop 34 and to one input terminal 83 of an OR circuit 84. The pulse triggers the flip-flop 34 into its "0" state, thereby resetting the flip-flop. Moreover, the pulse clamps the flip-flop to the "0" state for the length of time it is applied to the terminal 82, e.g., 20 seconds. This allows a person sufficient time to leave the building without setting an alarm because a signal received from one of the sensor devices 10 during that interval will not set the flip-flop 34.

The OR circuit 84, which may be of conventional construction, transmits the twenty second pulse to an alert oscillator 86, of conventional construction, which generates a high frequency signal for driving a loudspeaker 88. The loudspeaker 88 generates an audible whistling sound to alert the proprietor of the building that the device 28 has been activated. At the end of the delay period, which is determined by the delay circuit 80, the alert oscillator 86 turns off and the flip-flop 34 remains reset to accept a signal from any one of the sensor device 10 located throughout the building.

When entry, authorized or unauthorized, is made through an access opening having a sensor device 10 disposed adjacent thereto, the signal generated by the device

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10 is detected, amplified and supplied to the set input terminal 33 of the flip-flop 34. This signal triggers the flip-flop into the "1" state and a voltage signal will thereby be supplied from the "1" side output terminal 35 through a conductor 90 to a relay 92, a loud alarm delay circuit 94, the second input terminal 95 of the OR circuit 84 and to a second relay 96.

Because one side of the relay 92 is connected to ground, the relay 92 is energized by the voltage signal supplied from the flip-flop 34. Energization of the relay 92 will cause the activation of its associated contact 92a to the normally open position and a 115 volt, 60 cycle power signal will be coupled across a lamp 98, the lamp providing a visual indication that entry has taken place. Instead of coupling the 115 volt, 60 cycle signal to a lamp, it should be understood that the contact 92a could couple the signal to any other electrical device, such as, for example, a radio. Connected across the contact 92a is a manually operated switch 100 which provides power to the lamp 98 when the device 28 is deactivated, as will be described hereinbelow.

The OR circuit 84 transmits the constant voltage signal to the alert oscillator 86 which, in turn, supplies a high frequency signal to the speaker 88. The speaker generates an audible whistling sound for the length of time that the flip-flop 34 remains in its set or "1" state. Also responsive to the constant voltage signal is the delay circuit 94 which transmits an output pulse to a driver circuit 102 a selected period of time after the flip-flop 34 has been set, such as, for example, twenty seconds. The driver circuit, if activated, thereupon drives a bell 104 which generates a loud ringing sound. Activation of the driver circuit 102, which may be of conventional construction, is controlled by the relay 96 inasmuch as the control terminal of the driver circuit is connected to the normally open terminal of the contact 96a, the arm of the contact 96a being connected to ground.

Energization of the relay 96 is implemented only if a manually operated on-off switch 106 is closed to its "on" position. When the switch is thrown to the "on" position, the relay 96 is energized by the constant voltage signal supplied from the flip-flop 34, the contact 96a is then actuated to the normally open position and the control terminal of the driver circuit 102 is coupled to ground through both the switch 106 and the contact 96a. The driver circuit 102 then drives the bell 104 which supplies the highly audible loud alarm indication of an intrusion. If the loud alarm indication is disabled by manually actuating the switch 106 to the off position before the flip-flop 34 is activated, the light 98 provides the visual indication of the entry or intrusion. It is noticeable that the relay 96 is locked in an energized state by its contact 96a. This prevents an intruder from deenergizing the relay by actuating the switch 106. The purpose of the inclusion of the delay circuit 94 is to allow an authorized person to enter the protected building and disable the device 28 before the loud alarm sounds.

The flip-flop 34 remains in the set or "1" state until the pushbutton switches 52e, 52h and 52l of the manual keyboard 46 are momentarily depressed (FIG. 3). When these pushbutton switches are momentarily depressed, D-C power from the OR circuit 44 is coupled through the contact 72a of the relay 72 and through the conductor 71 to the land area 70 of the printed circuit board 54, through the pushbutton switches 52o-52a and the start pushbutton switch 50 to the land area 66, through the conductor 75 to ground, thereby shorting out the relay 72 and deenergizing it. The deenergization of the relay 72 causes its associated contact 72a to return to its normally closed state, the power voltage is removed from the flip-flop 34 and the system is deactivated.

In operation, the device 28 is primed by simultaneously depressing the start pushbutton switch 50 and the pushbutton switches 52e, 52h and 52l. This momentarily couples the D-C power signal from the OR circuit 44 to

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the coil of the relay 72 and to the delay circuit 80 which, in turn, generates a twenty second pulse which resets the flip-flop 34 and initiates a twenty second alert alarm. This delay enables the proprietor to leave the building without triggering a loud alarm inasmuch as the flip-flop 34 will remain clamped to the "0" or reset condition for as long as the delay circuit 80 is operative.

When an intrusion takes place, the reed switch 20 of the sensor device 10 will return to its normally closed position because the magnet 22 affixed to the movable element at the access opening will have been displaced and the sensor device 10 will then emit an RF signal frequency modulated with a tone signal. This signal is detected and amplified in the device 28 and supplied to the set input terminal 33 of the flip-flop 34. This triggers the flip-flop into a set state, the flip-flop 34 generating a constant voltage signal which initially triggers an alert alarm indicator 88, a visual alarm indicator 98 and thereafter triggers an audible loud alarm indication. The alert and loud alarms will remain until the device is reset by the momentary depression of the pushbutton switches 52e, 52h and 52l.

It will be understood that the invention is susceptible of considerable modification and not limited to the above described illustrative embodiment. For example, the system can be changed to a fire alarm system merely by employing a heat responsive switch in place of the reed switch 20. The system can be employed for pressure detection, water detection or for any number of purposes merely by employing the appropriate condition responsive switch in the sensor device 10. Accordingly, all such modifications and variations are intended to be included within the scope of the present invention as defined by the following claims.

We claim:

1. A property protection alarm system comprising at least one self-contained signal transmitter for disposition at an area to be protected, each signal transmitter being responsive to a selected change in condition to activate the signal transmitter, and a remotely disposed receiver unit responsive to a signal generated by the signal transmitter for initially generating an alert alarm and for thereafter generating a loud alarm, said receiver unit comprising a coded switching means for controlling activation and deactivation of the receiver unit and a delay circuit responsive to the operation of the coded switching means for activating the alert alarm for a selected period of time and for disabling the receiver unit from providing a loud alarm for the same period of time.

2. An alarm system according to claim 1 wherein the coded switching means comprises a manual keyboard having a coded array of switches.

3. An alarm system according to claim 2 wherein the receiver unit further comprises a bistable device responsive to the signal generated by the signal transmitter for generating an alarm signal, an alert oscillator responsive to the alarm signal for generating an alert alarm signal and a second delay circuit responsive to the alarm signal for generating a loud alarm signal a selected period of time after the generation of the alarm signal by the bistable device.

4. An alarm system according to claim 2 wherein the bistable device includes means responsive to the depression of preselected switches of the manual keyboard for generating a disabling signal to thereby disable the alert alarm oscillator and the second delay circuit.

5. An alarm system according to claim 4 wherein the receiver unit further comprises a loudspeaker responsive to the alert alarm signal for producing an audible whistling sound and a bell responsive to the loud alarm signal for producing a highly audible ringing sound.

6. An alarm system according to claim 5 wherein the signal transmitter comprises a rechargeable source of electrical potential, a radio frequency oscillator and FM modulator, audio tone oscillators coupled to the radio

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frequency oscillator and FM modulator and a condition responsive switch for coupling the rechargeable source of electrical potential to the radio frequency oscillator and FM modulator and to the audio tone oscillators.

7. A burglar alarm system, comprising at least one self-contained signal transmitter for disposition at an access opening of the building to be protected, each transmitter including a condition responsive switch for activating the signal transmitter whenever the movable element of the access opening is moved, and a remotely disposed receiver unit responsive to a signal generated by the signal transmitter for initially generating an alert alarm and for thereafter generating a loud alarm, said receiver unit comprising a rechargeable source of electrical potential, a manual keyboard coupled to the rechargeable source and including a coded array of momentary pushbutton switches for momentarily transmitting an electrical signal potential, a delay circuit responsive to the momentarily transmitted electrical signal for activating the alert alarm for a selected period of time and for disabling the receiver unit from providing a loud alarm for the same selected period of time.

8. A burglar alarm system according to claim 7 further comprising a magnet for affixation to the movable element of the access opening and wherein the condition responsive switch comprises a reed switch operated by the magnet.

9. A burglar alarm system according to claim 7 wherein the receiver unit further comprises a bistable device re-

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sponsive to the signal generated by the signal transmitter for supplying an alarm signal, an alert oscillator responsive to the alarm signal for generating an alert alarm signal and a second delay circuit responsive to the alarm signal for generating a loud alarm signal a selected period of time after the alarm signal is supplied by the bistable device.

10. A burglar alarm system according to claim 9 wherein the receiver unit further comprises means responsive to the alarm signal supplied from the bistable device for supplying a visual alarm indication and a manually operable switch for selectively disabling the receiver unit from providing a loud alarm prior to the occurrence of the alarm signal.

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THOMAS B. HABECKER, Primary Examiner

J. MICHAEL BOBBITT, Assistant Examiner

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