

[54] **ULTRASONIC BURGLAR ALARM SYSTEM**[76] Inventor: **Albert L. Hermans**, c/o Seaboard Electric, 2255 Bancroft Ave., San Leandro, Calif. 94577[22] Filed: **Feb. 22, 1972**[21] Appl. No.: **228,138**[52] U.S. Cl. **340/276, 340/258 B, 340/261, 340/275**[51] Int. Cl. **G08b 13/16**[58] Field of Search... **340/258 R, 258 B, 258 D, 261, 340/276, 275, 280**[56] **References Cited****UNITED STATES PATENTS**

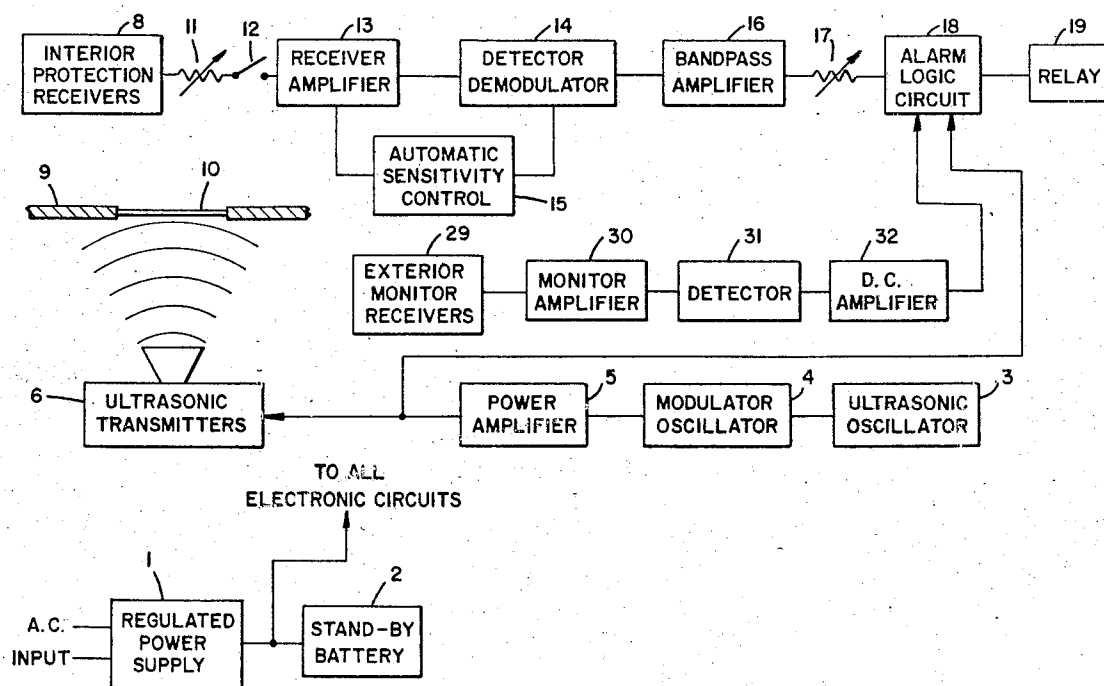
2,071,933	2/1937	Miessner	340/261
3,061,829	10/1962	Roberts	340/258 R
3,491,332	1/1970	Lomas et al.	340/258 B X

3,569,924 3/1971 Drake et al. 340/258 B X

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Attorney—Harris Zimmerman

[57] **ABSTRACT**

An ultrasonic burglar alarm system employing one or more transmitters on the exterior of the protected enclosure, and one receiver in the interior of the enclosure. An ultrasonic sound transmission path can exist, but normally it is not completed because of the intervening walls and closed doors and windows of the enclosure. Upon opening of any door or window, or any breaching of the walls, the sound transmission path is completed from exterior to interior, the received sound is detected, and an alarm is given. A supervisory circuit employing exterior receivers is also used, so that if an attempt is made to muffle any exterior transmitter or impair any exterior receiver, an alarm is given.

10 Claims, 3 Drawing Figures

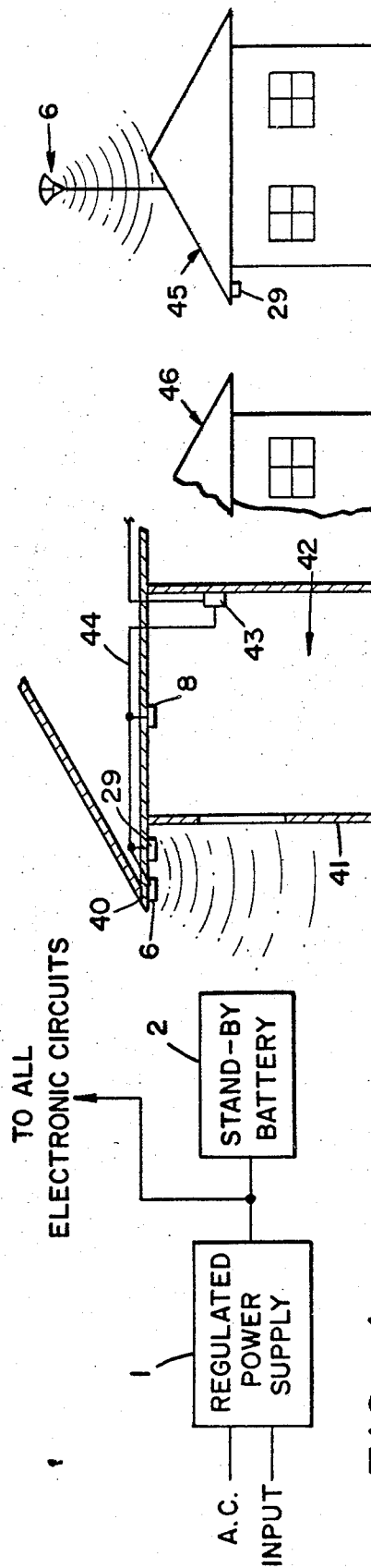
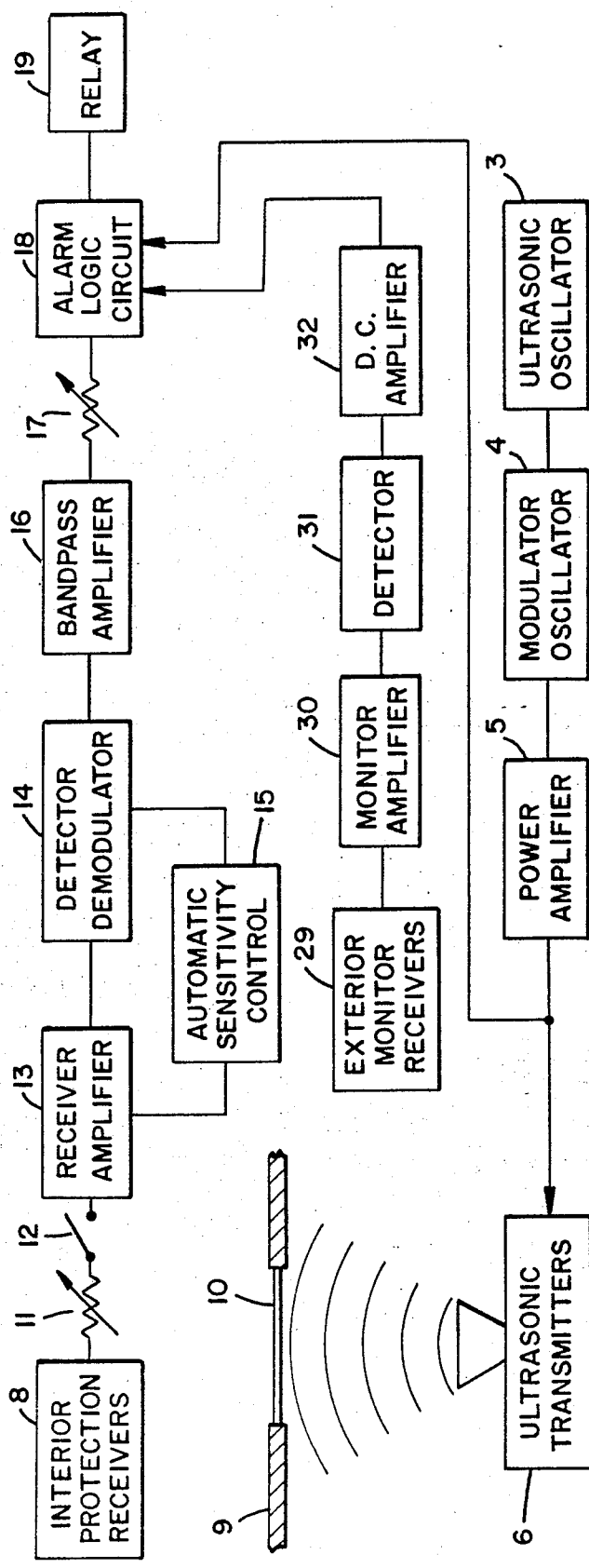


FIG_1

FIG_2

FIG_3

ULTRASONIC BURGLAR ALARM SYSTEM

BACKGROUND OF THE INVENTION

Many intrusion detection systems have been employed in the past to combat burglary and theft. These systems can be categorized as either space detection systems or perimeter protection devices. The space detection systems operating on the microwave or ultrasonic standing wave principle, have serious disadvantages due to their sensitivity not only to air turbulence caused by heating and air conditioning, but also to ambient sound and vibration. Their most serious drawback is that they permit no human activity inside the protected area. The perimeter protection systems, using door and window switches and conductive tape on glass surfaces can be defeated easily by experienced burglars by tampering with the switches, or avoiding the detectors altogether, i.e., by cutting through a wall.

It is therefore an object of this invention to provide an intrusion and burglar alarm system which permits authorized human activity inside the protected enclosure. It is also an object of this invention to provide a burglar alarm system which cannot be circumvented or defeated. It is another object of this invention to provide a burglar alarm system which can be used in a variety of installations to protect may different kinds of enclosures.

SUMMARY OF THE INVENTION

The present invention employs one or more ultrasonic transmitters located on the exterior of the protected enclosure. The transmitters emit modulated ultrasonic sound toward the enclosure. The enclosure may be a house, warehouse, freight car, jewelry case, safe, etc. Also mounted on the exterior of the enclosure is one or more monitoring receivers associated with each transmitter which continually receive the modulated sound from the transmitters. The output of the monitoring receivers is checked by a supervisory circuit, which will actuate the alarm if any monitoring receiver is not receiving sound from its associated transmitter. Thus any attempt to defeat the system by muffling the transmitter or impairing the monitoring receiver will cause an alarm.

Located in the interior of the enclosure is one or more receivers tuned to receive the ultrasonic sound from the transmitters. The sound transmission path must pass through the walls or openings (windows, doors, etc.) of the enclosure. Normally, however, the doors and windows will be closed, and the walls are impervious to the sound. If a burglar should attempt to break and enter, an opening will be created through which the sound transmission path will be completed. Thus the sound will be received by the interior receiver, the received signal will be detected, and the alarm will be actuated.

THE DRAWINGS

FIG. 1 is a block diagram of the circuitry of the present invention.

FIG. 2 is a representation of a typical mounting of the transmitter and receivers of one embodiment of the invention.

FIG. 3 shows another method of mounting the transmitter in another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The system is powered by a regulated power supply 1 and a constantly charged standby battery 2, which provide power to all electronic circuits. The ultrasonic oscillator 3 generates an ultrasonic signal of a predetermined frequency, on the order of 20,000 Hz, which is fed to the modulator-oscillator 4. The modulator-oscillator 4 modulates the ultrasonic signal from the oscillator 3 with a lower frequency signal, typically 250 Hz. The modulated signal is amplified by the power amplifier 5, and is then conducted to the ultrasonic transmitters 6, and the alarm logic circuit 18. Each of the ultrasonic transmitters 6 is located exteriorly of the protected enclosure, where it emits the modulated ultrasonic tone toward the interior of the protected enclosure.

Located inside the enclosure are receivers 8 separated from the transmitters 6 by the wall of the enclosure 9, in which there is a closeable opening 10 such as a door or window. The receivers 8 convert all received sound into an electrical signal. Each of the receivers 8 feeds the signal through a variable resistor 11 and a manual switch 12. The resistor 11 controls the sensitivity of each individual receiver 8, and the switch 12 allows the occupant of the enclosure to turn on or off individual receivers. The signal then goes to the receiver amplifier 13, where it is amplified, and thence to the detector-demodulator 14. There the predetermined frequency of the oscillator 3 is detected, if it is present. That detected signal is also demodulated, producing a signal of the frequency of the modulator-oscillator 4. A portion of the D.C. voltage level from the detector-demodulator 14 is sampled by the automatic sensitivity control 15, which uses that voltage level to control the gain of the receiver amplifier 13, assuring the constant sensitivity of the system.

The demodulated signal from the detector-demodulator 14 passes through the bandpass amplifier 16, where any extraneous signals are removed, and then to the variable resistor 17. This resistor 17 is a threshold detector which is adjusted to remove any leakage signals that might penetrate the perimeter of the enclosure 9. The adjusted signal then goes to the alarm logic circuit 18 which, when it senses the presence of the demodulated signal indicating the enclosure has been broken into, actuates the alarm relay 19, and an alarm is given.

Also located exteriorly of the enclosure 9 are monitor receivers 29 which continually receive the sound emitted by the transmitters 6. This received sound is converted to an electrical signal by the receivers 29, and that signal is amplified by the monitor amplifier 30. The amplified signal is detected by the detector 31, and the resulting D.C. voltage is amplified by the amplifier 32. It is then fed to the alarm logic circuit 18. If a would-be burglar attempts to muffle any of the transmitters 6 or impair any of the receivers 29, the received signal would be reduced, resulting in a reduced D.C. voltage level going to the alarm logic circuit 18 from the amplifier 32. The alarm logic circuit 18 senses the reduced voltage, and actuates the relay 19, giving the alarm.

It should be noted that in a typical installation of the instant invention, every exterior wall 9 of the protected

enclosure would have at least one of the transmitters 6 mounted exteriorly. Associated with each transmitter 6 and installed nearby would be one of the monitor receivers 29. Inside the protected enclosure, each room capable of being entered from the outside would have installed therein at least one of the interior receivers 8.

It should also be noted that the transmitter 6 and the monitor receiver 29 are each mounted inside identical metal boxes. Thus a would-be burglar would have difficulty discerning which unit could be tampered with. Also, each metal box can have a micro-switch tamper sensor mounted just under the cover of the box, so that any attempt to open either box would result in an alarm being given.

FIG. 2 shows a typical mounting of the active elements of the present invention in a home installation. The transmitter 6 and the monitor receiver 29 are mounted under the eaves 40 of a home 41. The receiver 8 is mounted on the ceiling of protected home 42, and the electronics of the burglar alarm system is mounted in the box 43. The transmitter 4, receiver 29 and receiver 8 are all connected to the central alarm system 43 by a multiconductor cable 44. Of course, if an attempt is made to cut the cable 44, the monitor signal from the receiver 29 to the alarm logic circuit 18 in the box 43 would be interrupted and the alarm would be sounded. There may be other active elements 6, 29 and 8 connected to the central alarm system 43, to protect other walls and openings of the home.

The embodiment of the present invention shown in FIG. 3 requires only one transmitter 6 and one monitor receiver 29. The single transmitter is sufficiently powerful that, mounted atop the building 45, it emits enough sound to actuate any of the receivers 8 inside the building 45, if any opening is made in the building 45 to complete the sound transmission path. Although powerful, the transmitter 6 is ultrasonic, and therefore inaudible and unobtrusive.

It is also possible that if two buildings 45 and 46 are to be protected by one central alarm system, the single transmitter 6 can be used as the transmitter for both buildings. Considering the reduced number of active elements required, this type of installation would be very economical.

I claim:

1. A burglar alarm system for warning of intrusion into a protected enclosure comprising;
 - ultrasonic transmitter means, located exteriorly of said protected enclosure, to emit an ultrasonic signal of predetermined frequency;
 - interior receiver means, located inside said protected enclosure to receive said ultrasonic signal through any opening in said enclosure;
 - detector means connected to said interior receiver means to detect reception of said ultrasonic signal by said interior receiver means, and to emit an alarm actuating signal if said ultrasonic signal is detected;
 - alarm means connected to said detector means to sound an alarm upon reception of said alarm actuating signal from said detector means.
2. A burglar alarm system according to claim 1 wherein said ultrasonic transmitter means includes modulating means to modulate the output of said ultrasonic transmitter with a second predetermined

frequency, and wherein said detector means includes demodulator means to demodulate said received signal, and to emit an alarm actuating signal only if said demodulated tone of said predetermined frequency is detected.

3. A burglar alarm system according to claim 1 wherein said ultrasonic transmitter means comprises a single ultrasonic transmitter.

4. A burglar alarm system according to claim 1 wherein said protected enclosure comprises a human dwelling place, said ultrasonic transmitter means comprises a plurality of ultrasonic transmitters, each placed exteriorly of every exterior wall surface capable of being breached, and said interior receiver means comprises a plurality of interior receivers, one receiver placed in each room of said dwelling place capable of being entered from the outside.

5. A burglar alarm system according to claim 4, wherein one or more of said interior receivers includes switching means to selectively switch off and on said receivers.

6. A burglar alarm system according to claim 3 wherein said protected enclosure comprises a human dwelling place, and said interior receiver means comprises a plurality of interior receivers, one receiver placed in each room of said dwelling place capable of being entered from the outside.

7. A burglar alarm system according to claim 6, wherein one or more of said interior receivers includes switching means to selectively switch off and on said receivers.

8. A burglar alarm system according to claim 3 wherein said protected enclosure comprises a plurality of jewelry cases in a jewelry store, and said interior receiver means comprises a plurality of interior receivers, one placed in each of said jewelry cases.

9. A burglar alarm system according to claim 8, wherein said interior receivers include switching means to individually switch off and on said receivers.

10. A burglar alarm system for warning of intrusion into a protected enclosure comprising;

ultrasonic transmitter means located exteriorly of said protected enclosure, to emit an ultrasonic signal of predetermined frequency;

monitor receiver means, located exteriorly of said protected enclosure to receive said ultrasonic signal whenever said transmitter is operating;

interior receiver means, located inside said protected enclosure, to receive said ultrasonic signal through any opening in said enclosure;

detector means connected to said interior receiver means to detect reception of said ultrasonic signal by said interior receiver means, and to emit an alarm actuating signal if said ultrasonic signal is detected;

supervisory circuit means connected to said monitor receiver means to detect continuous reception of said ultrasonic signal by said monitor receiver means, and to emit an alarm actuating signal if said continuous reception is interrupted for more than a predetermined period;

alarm means connected to said detector means and to said supervisory circuit means to sound an alarm upon reception of said alarm actuating signal from said detector means or said supervisory circuit means.

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