

Jan. 29, 1957

C. L. LOUDON ET AL

2,779,935

NOISE ACTUATED DISABLING UNIT

Filed March 21, 1955

2 Sheets-Sheet 1

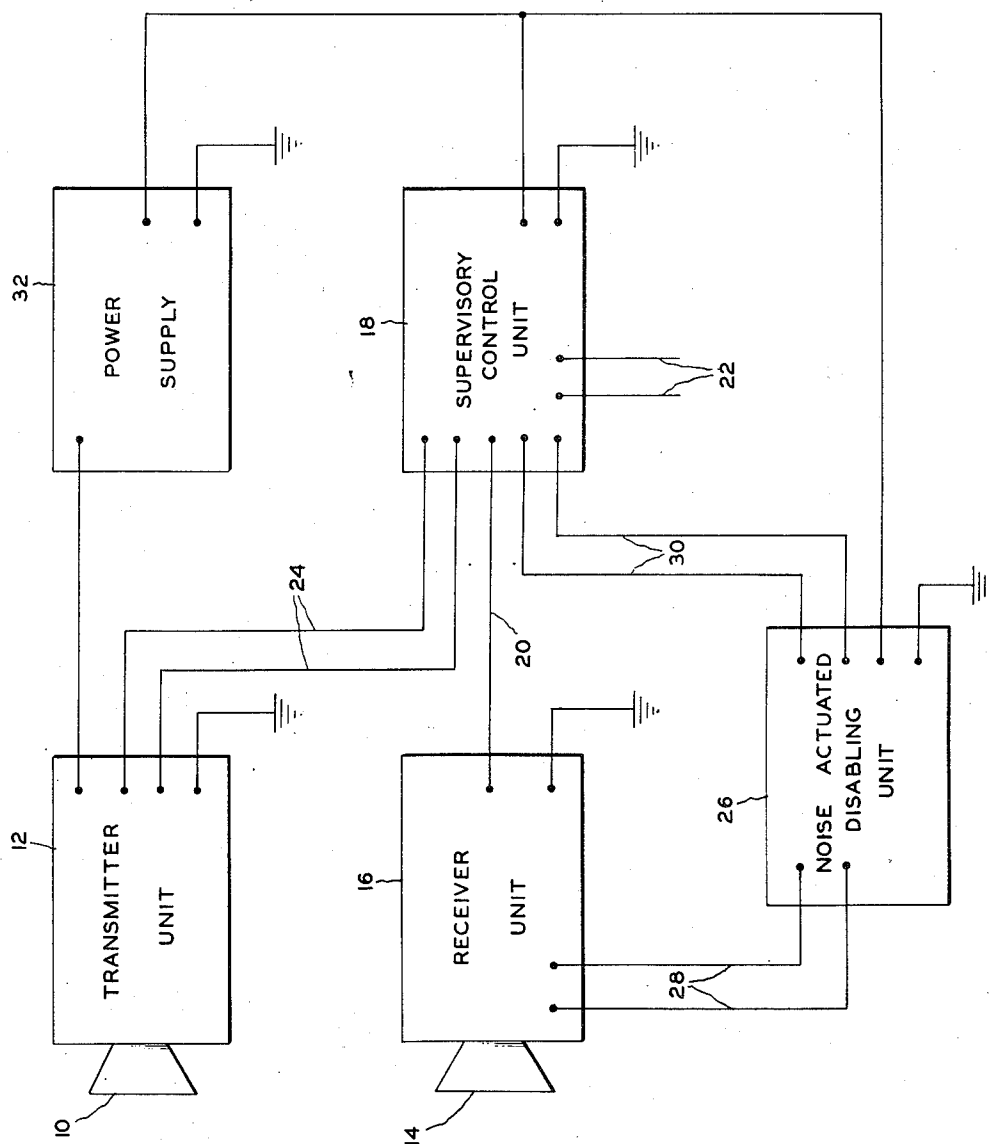


FIG. 1.

INVENTORS

William E. Riker
Clifford L. Loudon

BY *David D. McKenney*
ATTORNEY

Jan. 29, 1957

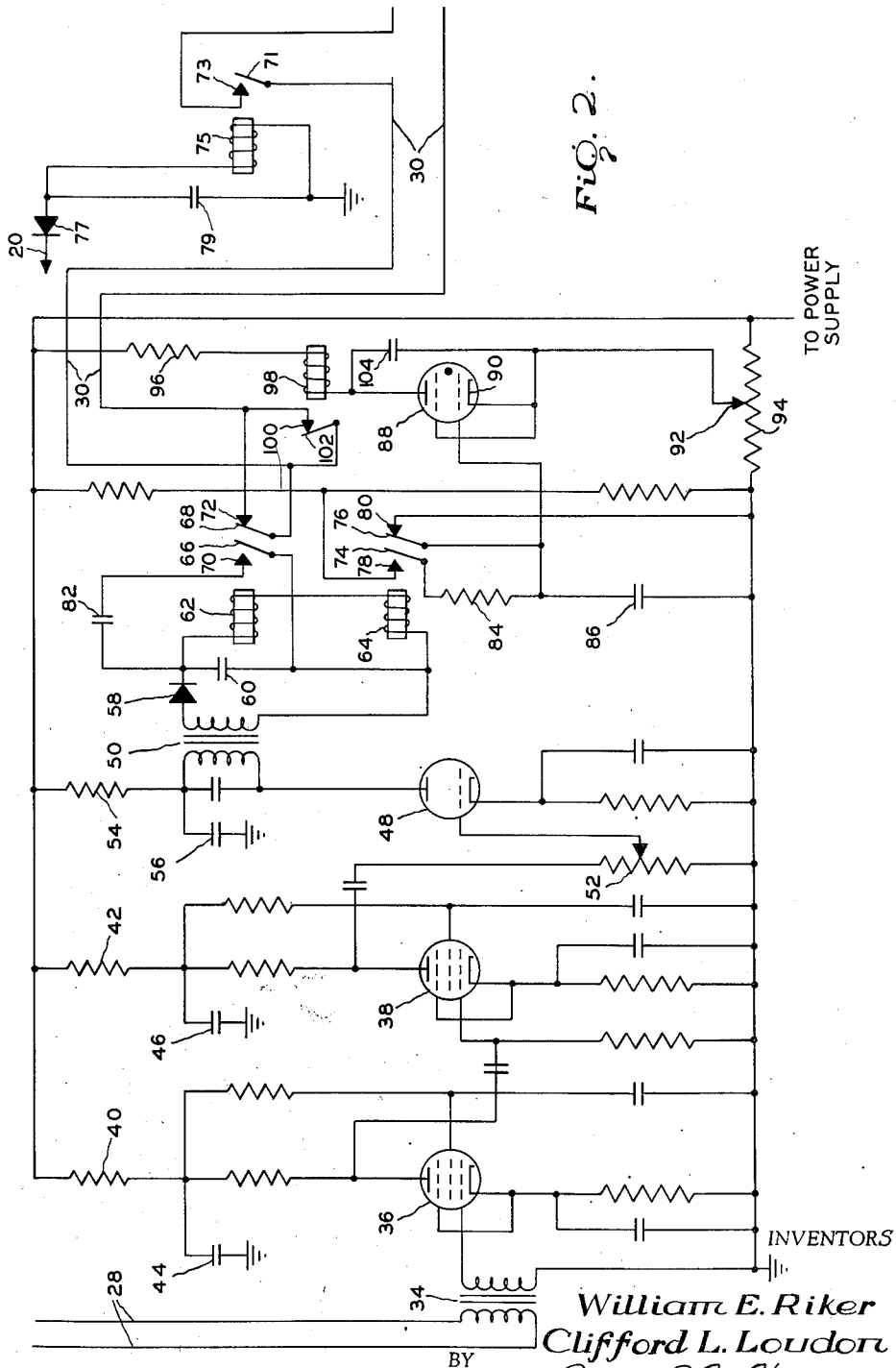
C. L. LOUDON ET AL

2,779,935

NOISE ACTUATED DISABLING UNIT

Filed March 21, 1955

2 Sheets-Sheet 2



William E. Riker
Clifford L. Loudon
David D. McKennee
ATTORNEY

1

2,779,935

NOISE ACTUATED DISABLING UNIT

Clifford Lee Loudon, La Jolla, Calif., and William E. Riker, Cold Spring Harbor, N. Y., assignors to Holmes Electric Protective Company, New York, N. Y., a corporation of New York

Application March 21, 1955, Serial No. 495,485

15 Claims. (Cl. 340—258)

The present invention relates to a space type burglar alarm system and in particular to a noise actuated disabling unit for use with such systems which unit will temporarily disable the burglar alarm system as a result of random noises within the protected area.

When ultrasonic waves at a fixed frequency are propagated within a protected enclosure a standing wave pattern is established. A microphone located within the enclosure will pick up these waves after they have undergone a complex process of reflection and absorption. Since all of the reflecting surfaces in the enclosure are stationary, the frequency of all the energy acting on the microphone will remain constant at the frequency of the propagated waves. In addition, a substantially stationary standing wave pattern is set up in the enclosure so that each direct and reflected wave arriving at the microphone terminates there at some substantially fixed point between a loop and a node and consequently the amount of energy acting upon the microphone remains essentially constant. If an intruder enters the enclosure his movements will have two effects. First of all, the frequency of the waves which are reflected from the moving intruder will be modulated due to the Doppler effect; the amount of frequency deviation being dependent upon the rate of movement of the intruder. Secondly, the amount of mechanical energy acting upon the microphone will vary due to a change in the relative positions of the loops and nodes of the waves reflected from the intruder. This variation in mechanical energy produces amplitude modulation. These amplitude and frequency modulated signals are converted to electrical energy by the microphone and the signals thus produced are used to actuate the burglar alarm. Difficulty with this type of system arises when stray noises having a frequency component near the frequency of the propagated wave are picked up by the microphone. Such noises will be passed by the microphone and will cause actuation of the burglar alarm.

It is, therefore, the primary object of the present invention to provide a noise actuated disabling unit which will render the burglar alarm system inoperative as a result of random noises without decreasing the protective value of the system.

Another object of the present invention is to provide a noise actuated disabling unit for a space type burglar alarm system which renders the system inoperative for a predetermined period of time in response to random noises about the protected enclosure but which returns the alarm system to operating condition if the noise persists.

It is another object of the present invention to provide a noise actuated disabling unit for space type burglar alarm systems which may be built up of a relatively small number of readily available components.

It is another object of the present invention to provide a noise actuated disabling unit in which the period of disabling is readily controllable.

2

Another object of the present invention is to provide a noise actuated disabling unit which is responsive to a wide range of audio frequency but is unresponsive to frequencies in the range of those of the propagated wave.

In accordance with the present invention there is provided a noise actuated disabling unit for use with a space type burglar alarm system which will render the system inoperative for a predetermined length of time when random noises are propagated within the protected enclosure. Such noises may arise as a result of the ringing of a telephone, noises in a steam pipe or creaking in structural members of the building. At the same time this unit makes it impossible for an intruder to render the system inoperative for more than a few seconds with a noise maker or similar device.

When random noises are present they are amplified by this unit and actuate a relay which renders the alarm system inoperative.

The actuation of the relays also causes a condenser to be charged. This condenser is located in the grid circuit of a gas discharge tube and after a predetermined charging period will cause the tube to fire. The firing of the tube will actuate a relay which will cause the contacts opened by the first relay to be shorted thereby rendering the alarm system operative. Therefore, if the noise persists for only a short period which is usually the case with random noises of the type described, the alarm system will not be operated. However, if the noise persists for an unusually long time the system will again be rendered operative.

In the drawings:

Figure 1 is a block diagram of the general type of system in which the present invention may be employed.

Figure 2 is a wiring diagram of the unit of the present invention.

Referring to Figure 1, ultrasonic waves at a frequency of about 17,000 cycles per second are propagated in the protected enclosure by the loud speaker 10 which receives oscillatory electrical energy from the transmitter unit 12. The frequency control in this transmitted unit may be a standard oscillator incorporating negative feedback for stabilization of the output frequency. A microphone 14 picks up the ultrasonic wave energy and converts it to electrical energy which is fed to the receiver unit 16. The output of the receiver unit is fed to the supervisory control unit 18 over the line 20. If an intruder enters the enclosure, an output signal is produced on the line 20 by the receiver unit and actuates the alarm circuits in the supervisory control unit. A signal is thereby produced on the lines 22 which are connected to the central office which is not shown. The supervisory unit 18 in addition to containing the alarm circuits has provisions for periodically testing the operability of the overall system. For this purpose it is necessary that certain conditions in the transmitter unit 12 be modified by the supervisory control unit and therefore the latter unit is connected over the lines 24 to the transmitter unit.

The noise actuated disabling unit has its input connected over the lines 28 to the output of the microphone 14; the connection being made in the receiver unit 16. The output of this unit is connected over the lines 30 to the supervisory unit. Power is supplied to the system by the power supply 32.

The receiver unit 16 is responsive to only a narrow band of frequencies centered about the frequency propagated by the loudspeaker 10, and therefore, this unit will only be sensitive to noises containing a frequency component which is close to the frequency of the propagated wave. The noise actuated disabling unit is respon-

sive to a wide band of audio frequencies and therefore will be actuated by any random noise since all such noises will contain audio frequencies. However, this circuit will not operate from the signal caused by an intruder moving in the protected enclosure since as pointed out above it will respond only to signals in the audio range while the signals caused by an intruder are in the ultrasonic range.

Fig. 2 shows in detail the preferred form of the noise actuated disabling unit. Input wires 28 are connected to receive a portion of the output of the microphone 14 in the receiver unit 16. Operation occurs when the microphone 14 picks up a noise of sufficient amplitude and with a frequency or frequencies within the range of approximately 300 to 15,000 cycles per second. Wires 28 lead the output of the microphone through an iron core impedance matching transformer 34 to the grid of the first of two similar amplifier tubes 36 and 38. These tubes are resistance-capacitance coupled pentodes, operated class A1, self-biased and containing decoupling resistors 40 and 42 and capacitors 44 and 46 in their respective plate supply connections. The tube 48 in the third and final stage of amplification is also self-biased and operated class A1, but the plate is coupled to its load through an iron core transformer 50. Tube 48 must be able to provide power amplification. The grid resistor 52 in this stage is a potentiometer which controls the gain of the unit. Decoupling resistor 54 and capacitor 56 are also used in this stage's plate supply circuit.

The output of transformer 50 is rectified by a germanium diode 58, filtered by an electrolytic capacitor 60 and then used to operate two relays 62 and 64 connected in series. Relay 62 has two armatures 66 and 68, a front contact 70 for armature 66 and a back contact 72 for armature 68. Similarly relay 64 has two armatures 74 and 76 and front and back contacts 78 and 80, respectively, therefor. The front contact 70 of relay 62 and its associated armature 66 bridges an electrolytic capacitor 82 across the windings of the two relays 62 and 64 when these relays are operated. The armature 68 and contact 72 of the relay 62 are connected in series with the armature 71 and contact 73 of the relay 75, the connection being made over the leads 30. These contacts and armatures are connected in the alarm circuit leading to the central office. If an intruder enters the protected enclosure a signal is developed on the lead 20 by the output of the receiver unit 16. This signal is rectified by the rectifier 77 and filtered by the capacitor 79 to produce a D.-C. signal which actuates the relay 75. If the armature 68 is engaging contact 72, energization of the relay 75 pulls armature 71 against contact 73 and a signal will appear in the central office circuit. The capacitance of the capacitor 79 is chosen so as to provide a short time delay between the appearance of a signal on the lead 20 and actuation of the relay 75. The capacitor 60 has a smaller capacitance than capacitor 79 so that when a noise occurs, relays 62 and 64 operate before alarm relay 75. Armature 68 moves away from its contact 72 and opens the connection between the lines 30, thus preventing a signal from being received in the central office. However, a capacitor 82 bridged across relays 62 and 64 has a larger capacitance than capacitor 79 in the alarm relay circuit, and consequently when the noise ceases, armature 71 will fall away from alarm relay contact 73 and end the signal before armature 68 closes against its back relay contact 72. As a result prevention of a signal in the central office due to noise is assured.

When the relays 62 and 64 are energized the front contact 78 of relay 64 applies a voltage through its associated armature 74 to a series connected resistance-capacitance circuit containing resistance 84 and capacitor 86. The application of this voltage slowly charges the capacitor 86 so that, up to a limit, the longer the relays

62 and 64 are held operated, the greater the voltage across the capacitor 86. This voltage is the grid potential for a gas tube 88. The cathode 90 of this tube is connected to the variable tap 92 on a potentiometer 94 which is bridged from B plus to ground, so that, by varying the position of tap 92, the cathode 90 can be set at any potential desired, and the amount of grid voltage required to trigger the gas tube 88 can be changed. Since the grid voltage in the gas tube 88 is a function of the time the relay 62 and 64 have been held operated, this tube can be made to fire at any time, within limits, after these relays are first actuated.

A current limiting resistor 96 and another relay 98 are connected in series in the plate circuit of the gas tube 88. The front contact 100 and armature 102 of this relay are parallel with contact 72 and armature 68 of relay 62 which opens the alarm circuit to the central office upon the occurrence of a noise. Therefore, the alarm circuit to the central office will be closed again when the gas tube 88 fires and relay 98 is energized. Thus if the noise persists beyond a preset length of time, as it would if an intruder intentionally employed a noise maker in an attempt to keep the central office alarm circuit open, an alarm would eventually be transmitted to the central office.

Gas tube 88 is essentially a high frequency relaxation oscillator so that the plate relay 98 is intermittently energized and deenergized. An electrolytic capacitor 104 has been connected from plate to cathode in the gas tube to reduce its frequency so that the plate relay armature 102 can bear solidly against its contact 100.

The back contact 80 of the relay 64 and its associated armature 76 short out the grid capacitor 86 when relays 62 and 64 are not energized. This prevents the capacitor 86 from storing a charge from one actuation of the circuit to the next and insures the firing of gas tube 88 only because of a continuous noise of proper duration and not because of a series of short bursts of noise.

For purposes of clarity, a pair of relays 62 and 64 have been shown in the drawings. However, it will be understood that in view of simultaneous functioning, a single relay could just as well be utilized. Of course, in certain arrangements it may be more practical to utilize separate relays as shown.

It can be seen from the above that any noise within the audio range will cause the system to be rendered inoperative for a predetermined period of time after which the system again becomes operative. Thus random noises in the protected enclosure, that is, those containing a 17,000 cycles per second component, will not produce a false alarm, while on the other hand, an intruder cannot permanently disable the circuit by using a noise maker.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents, are therefore, intended to be embraced by those claims.

What is claimed is:

1. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising amplifier means for amplifying signals at frequencies within the certain frequency range, a first means responsive to the output of said amplifier means for rendering the alarm circuit inoperative, a second means responsive to the output of said amplifier means for producing a second signal, and means responsive to said second signal to overcome said first means

5

after a predetermined time to render the alarm circuit operative.

2. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising amplifier means for amplifying signals at frequencies within the certain frequency range, means for rectifying the output of said first named means, a first means responsive to the output of said amplifier means for rendering the alarm circuit inoperative, a second means responsive to the output of said amplifier means for producing a second signal, and means responsive to said second signal to overcome said first means after a predetermined time to render the alarm circuit operative.

3. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising means for amplifying signals at frequencies within the certain frequency range, means for rectifying the output of said first named means, a first means responsive to the output of said second named means for rendering the alarm circuit inoperative, a capacitor, a second means responsive to the output of said second named means for charging said capacitor at a constant rate, an electron tube having its control grid connected to said capacitor to cause said tube to conduct when said capacitor has been charged to a predetermined level, and means responsive to conduction of said tube to overcome said first means and render the alarm circuit operative.

4. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising means for amplifying signals at frequencies within the certain frequency range, means for rectifying the output of said first named means, a first and a second switch connected in parallel in the alarm circuit, said first switch being normally closed and said second switch being normally opened, a first means responsive to the output of said second named means for opening said first switch, a capacitor, a second means responsive to the output of said second named means for charging said capacitor at a predetermined rate, an electron tube having its control grid connected to said capacitor to cause said tube to conduct when the charge on said capacitor has reached a predetermined level and means responsive to conduction of said tube to close said second switch.

5. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising an amplifier for amplifying signals at frequencies within the certain frequency range, a rectifier connected in the output of said amplifier for rectifying the output thereof, a first and a second relay connected to be energized by the output from said rectifier, a first and a second switch connected in parallel in the alarm circuit, said first switch being normally closed and said second switch being normally opened, said first switch being opened upon the energization of said first relay, a capacitor, means responsive to the energization of said second relay to charge said capacitor at a predetermined constant rate, a gas discharge device having its control grid connected to said capacitor to cause said device to fire when the charge on said capacitor has reached a predetermined level, a third relay connected in the output circuit of said device to be energized when said device is fired, said second switch arranged to be closed when said third relay is energized.

6. The apparatus as defined in claim 5 in which means are provided to cause said first and second relays to be energized within a first predetermined period by the oc-

6

currence of an output from said rectifier and second means to prevent said first and second relays from being deenergized for a predetermined period after discontinuance of the output from said rectifier, said second period being longer than said first period.

7. Electrical apparatus responsive to the presence of electrical fluctuations having a frequency within a certain frequency range to alter the normal condition of an alarm circuit for a predetermined length of time, said apparatus comprising a first circuit adapted to receive fluctuations which occur at a frequency within the certain range, amplifier means in the first circuit for amplifying the fluctuations received, rectifier means in the first circuit for rectifying the amplifier means output, first and second switches in the alarm circuit, one of said switches being opened and the other being closed when the alarm circuit is in its normal condition, relay means in the first circuit adapted to be energized by an output from said rectifier means to actuate the said first switch, a second circuit, control tube means in the second circuit having a control electrode, relay means in the second circuit adapted to be energized by an output from the control tube means to actuate said second switch, a third circuit, capacitor means in the third circuit having one side connected to the control electrode, and a switch in the third circuit actuated by the first circuit relay means upon the energizing of the latter to cause the capacitor means to be charged.

8. The apparatus as defined in claim 7 in which the upper limit of the certain frequency range is substantially 15,000 cycles per second and the lower limit is substantially 300 cycles per second.

9. Electrical apparatus responsive to the presence of those electrical fluctuations which have frequency components within a certain frequency range to render an alarm device inoperative for a predetermined length of time, said apparatus comprising a first circuit adapted to receive fluctuations which occur at a frequency within the certain frequency range, amplifier means in the first circuit for amplifying the fluctuations so received, rectifier means in the first circuit for rectifying the amplifier means output, an alarm circuit in which the alarm device is located, a source of electromotive force in the alarm circuit for operating the alarm device, a first switch in the alarm circuit in series with the alarm device and the source, a second switch in the alarm circuit in parallel with the said first switch, said first and second switches being closed and opened, respectively, when no fluctuations are being received into the first circuit, relay means in the first circuit adapted to be energized by an output from said rectifier means to open the said first switch, a second circuit, control tube means in the second circuit having a control electrode and having an output which increases with increases in potential on the control electrode, relay means in the second circuit adapted to be energized by an output from the control tube means which exceeds a predetermined output to close the said second switch, a third circuit, capacitor means in the third circuit having one side connected to the control electrode, and a switch in the third circuit actuated by the first circuit relay means upon energizing of the latter to cause a potential to build up on the said one side of the capacitor and on the control electrode.

10. For an alarm system in which an alarm is given by having electrical fluctuations in a signal frequency range operate a signal switch to actuate alarm devices in an alarm circuit and in which a false alarm may be given by non-signal electrical fluctuations of short duration which have frequency components in the signal frequency range, electrical apparatus responsive to additional frequency components of the non-signal fluctuations which lie in a certain frequency range outside the signal frequency range to render the alarm devices inoperative for a predetermined length of time, said apparatus comprising a first circuit adapted to receive fluctuations which occur at a frequency within the certain

7

range, amplifier means in the first circuit for amplifying the fluctuations received, rectifier means in the first circuit for rectifying the amplifier means output, a first switch in the alarm circuit in series with the signal switch and alarm devices, a second switch in the alarm circuit in parallel with the first switch, said first and second switches being in closed and opened positions, respectively, when no fluctuations within the certain frequency range are being received into the first circuit, relay means in the first circuit adapted to be energized by an output from said rectifier means to open the said first switch, a second circuit, control tube means in the second circuit having a control electrode, said control tube means having an output which increases with increases in potential on the control electrode, relay means in the second circuit adapted to be energized by an output from the control tube means which exceeds a predetermined output to close the said second switch, a third circuit, capacitor means in the third circuit having one side connected to the control electrode, and a switch in the third circuit actuated by the first circuit relay means upon energizing of the latter to cause a potential to build up on the side of the capacitor means connected to the control electrode.

11. For an alarm system in which an alarm is given by having electrical fluctuations in a signal frequency range operate a signal switch to actuate alarm devices in an alarm circuit and in which the signal switch may be operated to give a false alarm by non-signal fluctuations of short duration having frequency components in the signal frequency range, electrical apparatus responsive to additional frequency components of the non-signal fluctuations which lie in a certain frequency range outside the signal frequency range to render the alarm devices inoperative for a predetermined length of time, said apparatus comprising a first circuit adapted to receive fluctuations which occur at a frequency within the certain range, amplifier means in the circuit for amplifying the fluctuations received, rectifier means in the first circuit for rectifying the amplifier means output, a first switch in the alarm circuit in series with the signal switch and alarm devices, a second switch in the alarm circuit in parallel with the first switch, said first and second switches being in closed and open positions, respectively, when no fluctuations within the certain frequency range are being received into the first circuit, relay means in the first circuit adapted to be energized by an output therefrom to open the said first switch, a second circuit connected to a power supply, control tube means in the second circuit and having a control electrode, said control tube means having an output which increases with increases in potential on the control electrode, relay means in the second circuit adapted to be energized by an output from control tube means which exceeds a predetermined output to close the said second switch, a third circuit connected to the power supply, capacitor means in the third circuit having one side connected to the control electrode, a switch in the third circuit actuated by the first circuit relay means upon the energizing of the latter to cause a potential from the power supply to build up on the side of the capacitor means connected to the control electrode, a fourth circuit connecting the two sides of the capacitor means, and a switch in the fourth circuit actuated to the open position by the energizing of the first circuit relay means and adapted to be closed upon the deenergizing thereof.

12. The combination as defined in claim 11 in which the time delays in the alarm system and in the apparatus are so chosen that the additional frequency components of non-signal fluctuations which are outside the signal frequency range actuate the first switch before the frequency components of the non-signal fluctuations which are within the frequency range actuate the signal switch.

13. The combination with an alarm system in which

8

electrical signal fluctuations in a signal frequency range are first amplified and then rectified to actuate a signal switch to give an alarm and in which the signal switch may be actuated to give a false alarm by non-signal fluctuations having frequency components in the signal frequency range, of electrical apparatus responsive to additional frequency components of the non-signal fluctuations which are outside the signal frequency range to render actuation of the signal switch incapable of giving an alarm for a predetermined length of time, said alarm system having an alarm circuit with the signal switch therein, said apparatus comprising a first circuit adapted to receive, amplify and rectify only the said additional frequency components, relay means in the first circuit energized by the rectified additional frequency components, a first switch in the alarm circuit actuated by energization of the first circuit relay means to render actuation of the signal switch incapable of giving an alarm, a second circuit, control tube means in the second circuit having a control electrode and an output which increases with the potential on said electrode, relay means in the second circuit energized by a predetermined control tube output, a second switch in the alarm circuit in parallel with the first switch and actuated by energization of the second circuit relay means to render actuation of the signal switch capable of giving an alarm, a third circuit, capacitor means in the third circuit having one side connected to the control electrode, and a switch in the third circuit actuated by energization of the first circuit relay means to apply a potential to the said one side of the capacitor means.

14. The combination as defined in claim 13 in which the time delays in the alarm system and in the apparatus are so chosen that upon termination of non-signal fluctuations having frequency components within the signal frequency range capable of actuating the signal switch and having additional frequency components outside the said range capable of actuating the first switch, the signal switch is de-actuated before the de-actuation of the first switch.

15. The combination with an alarm system which detects signal modulations on supersonic carrier fluctuations and actuates a signal switch by said detected modulations to give an alarm and in which the signal switch may be operated and a false alarm given by non-signal noises having supersonic frequency components similar to the signal modulated supersonic carrier fluctuations, of electrical apparatus responsive to additional components of the non-signal noises to render actuation of the signal switch incapable of giving an alarm for a predetermined length of time, said alarm system having an alarm circuit with the signal switch therein, said apparatus comprising a first circuit, receiver, amplifier and rectifier means in the first circuit for receiving, amplifying and rectifying, respectively, only the said additional frequency components of non-signal noise, relay means in the first circuit energized by the output of the rectifier means, a first switch in the alarm circuit actuated by energization of the first circuit relay means to render actuation of the signal switch incapable of giving an alarm, a second circuit control tube means in the second circuit having a control electrode and a predetermined output which occurs upon reaching a preselected potential on said electrode, relay means in the second circuit energized by the predetermined control tube output, a second switch in the alarm circuit in parallel with the first switch and actuated by energization of the second circuit relay means to render actuation of the signal switch capable of giving an alarm when the first switch is actuated, a third circuit, capacitor means in the third circuit having one side connected to the control electrode, and a switch in the third circuit actuated by energization of the first circuit relay means to apply a potential to said one side of the capacitor

means, whereby actuation of the first switch renders actuation of the signal switch incapable of giving an alarm until a sufficient potential builds up on the said one side of the capacitor means to reach the predetermined output of the control tube means and the second switch is actuated. 5

References Cited in the file of this patent

UNITED STATES PATENTS

2,422,542	Gustafsson	June 17, 1947
2,572,074	Terry et al.	Oct. 23, 1951
2,602,852	Lense et al.	July 8, 1952
2,623,931	Bagno	Dec. 30, 1952