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NEAR ALARM RECEIVER HAVING TIME DELAY OF DISCHARGE TYPE

Filed March 25, 1963

2 Sheets-Sheet 1

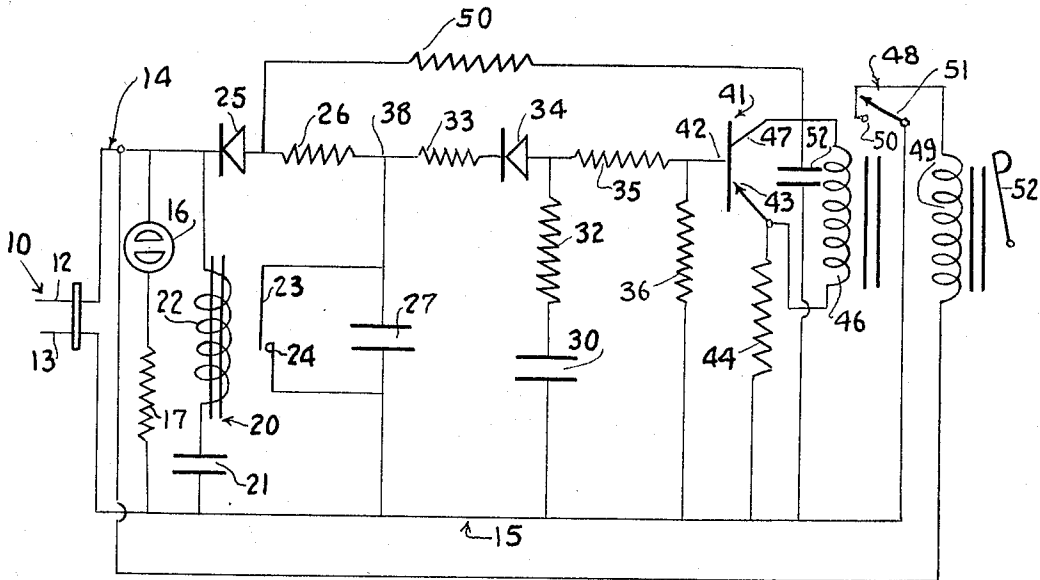


FIG. 1.

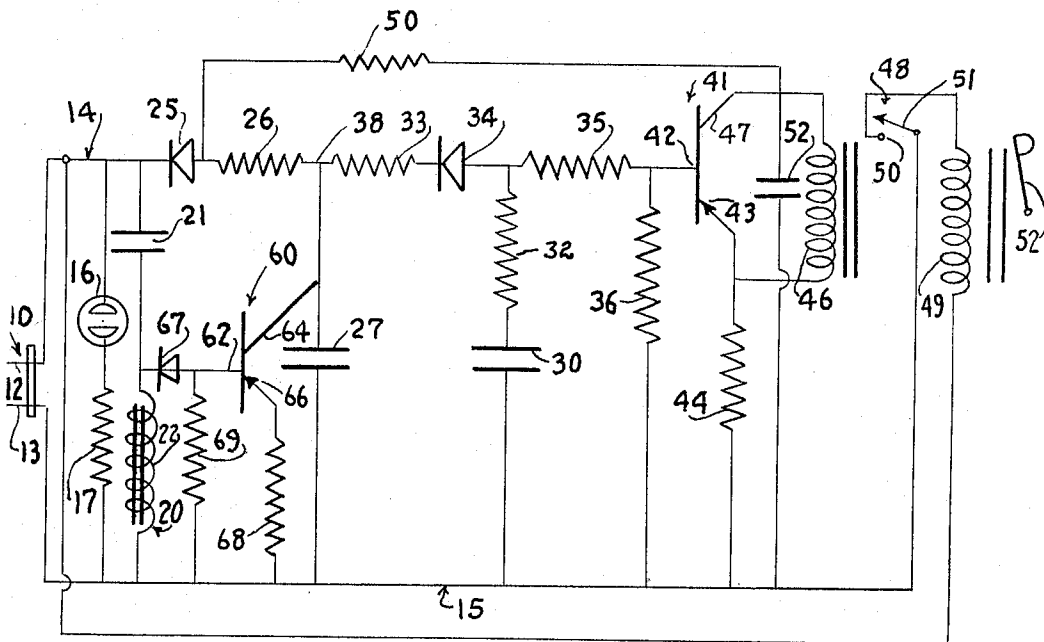


FIG. 2.

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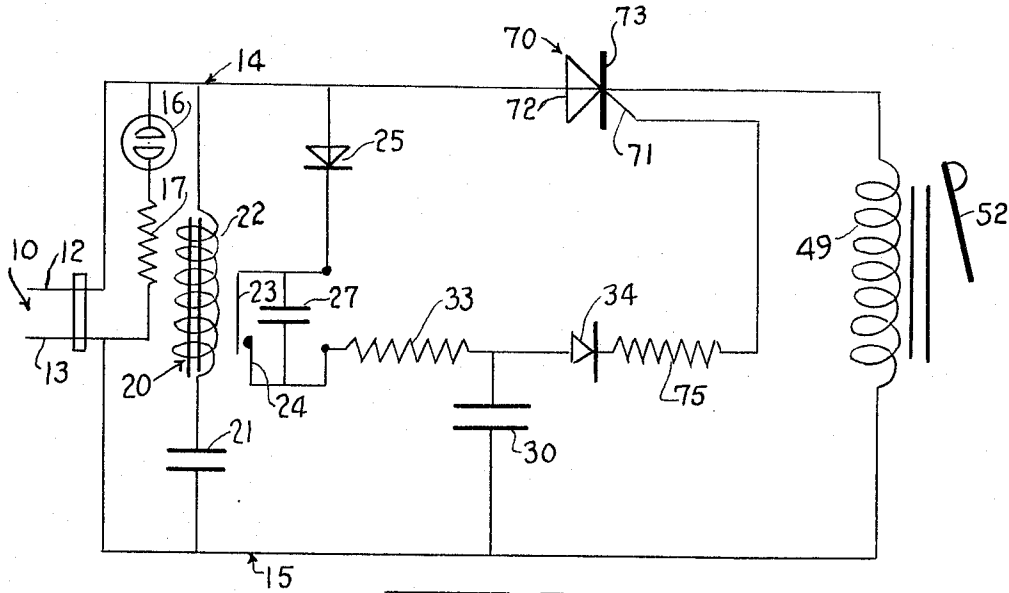


FIG. 3.

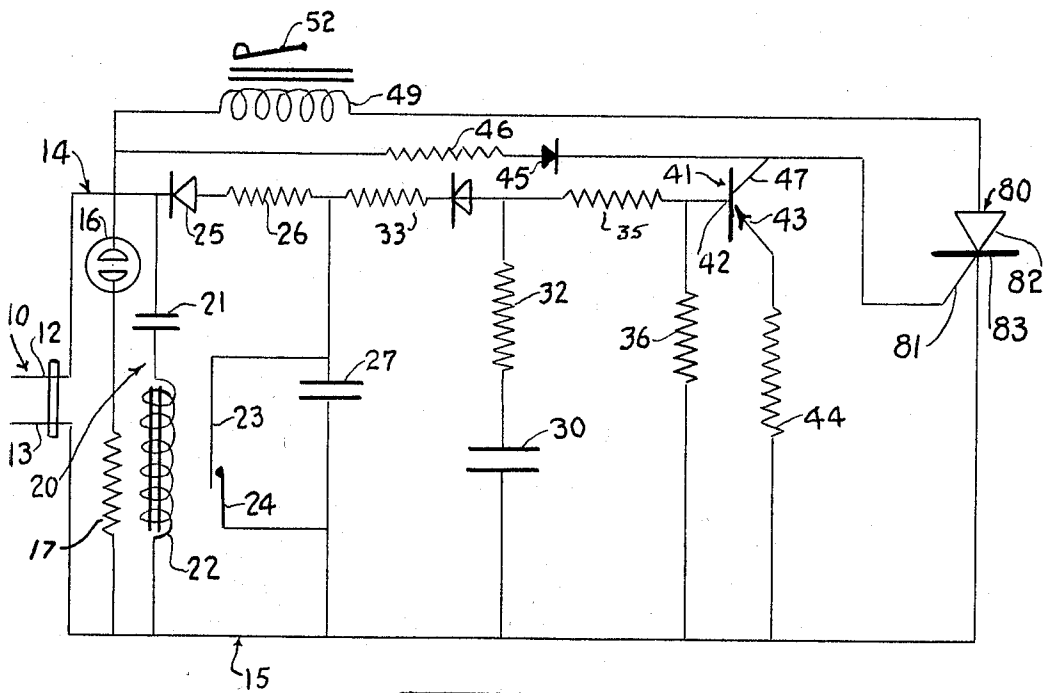


FIG. 4.

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**NEAR ALARM RECEIVER HAVING TIME DELAY OF DISCHARGE TYPE**

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 Filed Mar. 25, 1963, Ser. No. 267,655  
 16 Claims. (Cl. 340-310)

The present invention relates to electrical control circuits for producing a delayed action and controlled duration audible alarm, and more particularly to a receiving instrument preferably designed to be used in homes, offices and other buildings as a component of the National Emergency Alarm Repeater (NEAR) system and more particularly to such a receiver incorporating a solid state device for its major control function.

The task of providing a means of alerting the Nation of an impending enemy attack or other civil disaster has been given by Congress to the Office of Civil Defense. This office recognized early that some means had to be devised to supplement outdoor sirens in providing more effective warning since sirens often can not be heard indoors, and many suburban and rural areas are not within the range of hearing of the nearest municipal-siren system. After considerable research and investigation the conclusion was reached that it would be necessary to provide an indoor system which could be coordinated with outdoor warning systems already installed.

Such a system must reach the greatest possible number of homes and buildings and still not entail undue and prohibitive costs. Therefore it has been decided to use existing electric power lines and to provide special generators to transmit an electrical signal of controlled frequency and duration over these lines in the event of a national emergency. The generators will be used to superimpose a signal at a frequency of 270 cycles per second on the 60 cycles per second power which is normally transmitted over the power lines. A receiver unit, plugged into an ordinary A.C. wall receptacle, will respond with a loud buzzer-like sound when activated by an actuation signal of sufficient duration. The term NEAR voltage has been used to designate this actuation signal and will be so used hereinafter.

Certain safeguards must be built into the receiving component of the NEAR system to prevent false alarms. Means must be provided for delaying the sounding of the audible alarm for 10 to 25 seconds after receipt of the NEAR voltage so that brief transients which could be caused by lightning, electrical switching devices, and the like, will not result in an audible alarm. Also the time delay means cannot be cumulative to a series of transients or coded NEAR voltage signals of 2 to 5 seconds duration each, which might accumulate to result in a false alarm. The time delay means must be independent of power line voltage, temperature, humidity, and NEAR voltage amplitude, within the 10 to 25 second tolerance specified.

Further, the receiver must not sound an audible alarm when subjected to 50,000 pulses of NEAR voltage, with an amplitude of 3.0 volts R.M.S. with a 5 seconds on, 10 seconds off time cycle. The NEAR receiver to meet the requirements specified by the Office of Civil Defense must be very selective from the standpoint of signal frequency. The present NEAR voltage is 270 cycles per second and the minimum bandwidth is .9 cycle per second either side of the 270 cycles per second NEAR voltage. The receiver must also reject any NEAR voltage having an amplitude of less than .41 volt R.M.S. Also the receiver must reject noise and harmonics including a number of even order and odd order 60 cycles per second harmonics

which might also be present on the power line. These include 6.0 volts R.M.S. of 240 cycles per second.

Another requirement is that the receiver must have a useful minimum life of 5 years. In addition to meeting these critical performance requirements, the receiver must be relatively inexpensive, probably less than \$10.00.

Several different types of receivers have been heretofore provided to meet these requirements. Some of these have incorporated thermal time delay means such as described in Weber Patent No. 3,021,520 issued February 13, 1962. Such a time delay means when tested and evaluated have proven to be cumulative, in that they store energy during each NEAR voltage signal cycle, which has been found to ultimately result in a false alarm when subjected to the series of NEAR voltage, of the 3.0 volts amplitude with a cycle of 5 seconds on and 10 seconds off for 50,000 cycles, particularly when the receiver was subjected to elevated temperatures.

Another receiver heretofore provided utilizes a motor cam switching device for the time delay means. Such a receiver is too costly and since the timing motor is energized each time the actuating frequency is on the line whether this be the NEAR signal or brief transients caused by lightning, etc. it will be subject to undue wear. Also when the timing motor is in a standby condition there is the possibility that the gear train will seize after long periods of inactivity due to extremes of temperature or humidity, accumulations of dirt, or the like. This would result in an inoperative receiver.

Another receiver has utilized an R-C charging network for the time delay means. Such a receiver is entirely too dependent on NEAR voltage input, since this design also includes a resonant reed which when energized provides energy to the R-C network. Therefore weak NEAR voltage signals would provide very little charging energy. This condition is further aggravated when the alarm clapper is set into operation since this also effects the charging energy because the reeds are subject to vibration and the reed switching circuit loses a number of makes which causes a cutting down on the input energy level to the R-C network.

Copending application Ser. Nos. 169,463, and now U.S. Patent 3,155,958, 179,058 and now U.S. Patent 3,148,365 and 198,822, and now U.S. Patent 3,185,901, filed January 29, 1962, March 12, 1962 and May 31, 1962 respectively, describe and disclose a receiver unit incorporating a time delay means which utilizes an expandable fluid cell normally held in a closed position by a spring loaded solenoid. While such a receiver meets most of the necessary requirements, several disadvantages have been discovered with respect to this receiver. First, an audible click is sounded each time a NEAR voltage of sufficient amplitude is received. Secondly, the solenoid is subject to wear since it will respond to the presence of NEAR voltage, even if the duration of the NEAR voltage is not sufficient to result in an alarm.

To overcome the disadvantages of these prior receivers the present invention provides a NEAR receiver incorporating a solid state or transistor timing device. Such a receiver is not subject to wear or degradation when in a standby condition and undue wear does not result when coded pulses of NEAR voltage are received by the device.

It is an object of the present invention to produce a reliable signal receiving and audible warning device by providing an ultra sensitive signal detecting portion and a transistorized control and time delay portion.

Another object of the present invention is to provide a signal receiving and warning device which provides a fixed time delay period before sounding an audible alarm and in which the time delay means operates independently of the signal voltage, power line voltage, temperature or relative humidity.

It is yet another object of the present invention to provide an improved NEAR receiver device which will not respond to noise, harmonics, or NEAR voltage of .4 volt R.M.S. or less.

It is still another object of the present invention to provide an improved signal receiving and warning device which will not respond to transients produced by lightning bolts, switching or coded signals of 2 to 5 seconds duration, by providing a time delay means which is non-cumulative and which resets almost immediately.

It is still a further object of the present invention to provide a signal receiving and warning device which will not be subject to wear in the standby condition or when actuation signals of short duration are received by providing a transistorized control and time delay means.

Other objects and advantages of the present invention will readily occur to one skilled in the art to which the invention pertains upon reference to the following drawings in which like reference characters refer to like parts throughout the several views and in which

FIG. 1 is a schematic diagram of one preferred embodiment of the present invention.

FIG. 2 is a schematic diagram similar to FIG. 1 but illustrating another preferred embodiment of the present invention.

FIG. 3 is a schematic diagram similar to FIG. 1 but illustrating yet another preferred embodiment of the present invention.

FIG. 4 is a schematic diagram similar to FIG. 1 but illustrating still another preferred embodiment of the present invention.

#### Description

Now referring to the drawings for a more detailed description of the present invention, FIG. 1 illustrates schematically a preferred receiving unit comprising an input line plug, generally designated at 10, adapted for insertion into an ordinary A.C. wall receptacle (not shown) and having prongs 12 and 13, which are preferably connected to power lines 14-15 as shown. A neon lamp 16 and a dropping resistor 17 are connected across the power lines 14-15. The neon lamp 16 indicating that sufficient line voltage is present to operate the device.

A resonant circuit, generally indicated at 20, is connected across the power lines 14-15 and preferably includes a capacitor 21 and an inductor 22. A mechanical resonant reed leaf member 23 and a fixed contact member 24 are disposed within the magnetic field of the inductor 22 to form a discharge switch across a first capacitor 27. The first capacitor is connected across lines 14-15 and is charged from a rectifying diode 25 through a resistor 26 in the line 14 as shown.

The capacitor 21 and inductor 22 form a series electrically tuned resonance circuit (L-C circuit). The capacitive reactance ( $X_C$ ) of the capacitor 21 is substantially the same as the inductive reactance ( $X_L$ ) of the inductor 22 at the predetermined NEAR signal voltage; thus on receipt of this NEAR signal voltage, the reactances cancel one another and the maximum NEAR signal energy flows across the inductor 22. This maximum signal energy results in a substantial increase in magnetic energy across the air gap of the inductor 22 causing the leaf member 23 to vibrate. The leaf member 23 is mechanically tuned to resonate to the NEAR voltage frequency and will resonate at that frequency with sufficient amplitude to engage the fixed contact member 24, instantly discharging the first capacitor 27.

A second capacitor 30 is also connected across the lines 14-15 through a resistor 33, a blocking diode 34, and a resistor 32, as shown.

A resistor circuit comprising resistors 35 and 36 is connected across the lines 14-15 as shown and these, with the resistors 26 and 33 form a voltage divider network.

In the absence of NEAR voltage the capacitor 30 is at maximum electrical charge potential, being charged from

the pulsating D.C. source at rectifying diode 25, through resistors 26, 33 and 32, and blocking diode 34. When the capacitor 27 is discharged by the reed member 23 engaging the fixed contact member 24, the voltage potential across the capacitor 27 will drop from approximately 37 volts to less than 2 volts in the first few cycles of reed oscillation.

At the moment that the capacitor 27 is discharged the voltage potential at the junction 38 between the resistors 26 and 33 drops to less than 1.0 volt with respect to power line 15 and since now there is no longer a sufficient source of charging energy for the capacitor 30 it too will begin to discharge through the resistor network comprising resistors 32, 35 and 36.

A parallel discharge passage for the capacitor 30 is also provided through a PNP transistor 41 from its base 42 to its emitter 43 and thence through a bias resistor 44 to the line 15 as shown. The transistor 41 could be of NPN type and the charging polarities and biases would be reversed.

An alarm relay coil 46 is connected electrically in parallel with the emitter 43 and the collector 47 of the transistor 41. An alarm relay generally designated at 48 is connected across the lines 14-15 on the D.C. side of the rectifying diode 25, and comprises a coil 46, a fixed contact 50 and an armature 51 disposed within the magnetic field of the relay coil 46. The armature 51 is operable to engage the contact 50 and close the alarm circuit when the coil 46 is energized. A clapper 52 is disposed within the magnetic field of the coil 49 in a position to strike the control box (not shown) of the device when the coil 49 is energized, thus producing an audible alarm.

When in the standby condition and without the NEAR voltage signal present at the input plug 10 the PNP transistor 41 will have negative voltage on the base 42 in reference to the emitter 43 and the transistor 41 will conduct. With the relay coil 46 connected in parallel with the emitter 43 and the collector 47 of the transistor 41, and since the coil 46 has considerable more resistance than is present between the emitter 43 and the collector 47, little current will flow through the coil 46.

As capacitor 30 begins to discharge at the presence of NEAR voltage, as heretofore explained, the negative control bias on the base 42 of transistor 41 will decay at a predetermined rate depending upon the size of the capacitor 30 and the values of resistors 32, 35 and 36. The negative bias on the base 42 will continue to drop as long as NEAR voltage is present across the resonant circuit 20 with sufficient amplitude and duration. In a period from 10 to 25 seconds, this bias on the base 42 will shift from negative to positive bias with respect to the emitter 43. This will cause the resistance between the emitter 43 and the collector 47 of the transistor 41 to increase substantially, diverting sufficient current flow through the alarm coil 46 to cause the armature 51 to engage the fixed contact 50, thus energizing the coil 49 to cause vibration of the clapper 52 and produce the audible alarm.

The resistor 32 delays the charging of the capacitor 30 so that a negative bias will appear almost instantly at the base 42 of the transistor 41 when the device is first plugged in or after the line power is returned following a power failure. In the absence of resistor 32 an alarm would sound for a few seconds when the receiver was first plugged in or when the power returned after a power failure as would be the case when a fuse is blown on the circuit to which the NEAR receiver is connected. During the alarm cycle the positive bias on the base 42 with respect to the emitter 43 is produced by the resistor 44 in series with the emitter 43 with the return to the base 42 being completed through the resistor 36.

A filtering circuit is connected between the rectifying diode 25 and the line 15 as shown, comprising a dropping resistor 50 and a filter capacitor 52. The resistor 50 must be adjusted in value to agree with the operating param-

5

eters of the transistor 41 and the alarm coil 46. The purpose of the capacitor 52 is to filter out fluctuations in the pulsating D.C. current from the rectifying diode 25.

The blocking diode 34 prevents current flow from the capacitor 30 through the resistors 32 and 33, the reed member 23 and contact member 24. In the absence of the diode 34 the negative bias would be lost immediately on the base 42 of the transistor 41 and the alarm would immediately sound since both capacitors 27 and 30 would be discharged upon receipt of the NEAR voltage, which causes the reed member 23 to engage fixed contact member 24, shorting out the voltage potential on the capacitors 27-30.

FIG. 2 illustrates a modified receiving unit employing a transistor generally indicated at 60 for discharging the capacitor 27 in place of the discharge switch formed by the contact members 23-24 as shown in FIG. 1. The transistor 60 comprises a base 62, a collector 64 and an emitter 66. The base signal is fed from the resonance circuit 20 through a diode 67 and to the base 62 of the transistor 60. A nonconducting normal positive bias is developed on the base 62 with respect to the emitter 66 by employing a resistor 68, the circuit to the base being completed through a resistor 69 connected as shown. All of the other parts and functions of the FIG. 2 modification are identical with the embodiment shown in FIG. 1 and described above.

When a NEAR voltage is present across the line plug 10 a resonant condition exists across the resonant circuit 20. At resonance a signal appears across the inductor 20 and this signal is rectified by diode 67 and fed into base 62. This produces a negative bias on the base 62 with respect to the emitter 66 and current will be conducted by the transistor 60 between the emitter 66 and collector 64. Since the capacitor 27 is connected in parallel with the transistor emitter 66 and collector 64, the capacitor 27 will be shorted out and will be immediately discharged. This in turn will result in the delayed discharge of capacitor 30 as described above. The receiver then functions as described above and the alarm will be sounded after a time delay produced by the transistor 41.

FIG. 3 illustrates schematically another preferred modification of the present invention similar to FIG. 1 but in which the transistor 41 and alarm relay 48 have been replaced by a silicon controlled rectifier generally indicated at 70. As will be apparent as the description proceeds, this produces a system of charging rather than discharging as has been described above. The silicon controlled rectifier 70 is connected in series with the alarm coil 49 and comprises a gate 71, an anode 72 and a cathode 73.

The gate 71 is fed from line 14 through the rectifying diode 25, resonance reed switch members 23-24, resistor 33, blocking diode 34 and a resistor 75.

In this arrangement the response of the resonance circuit 20 is coupled to the gate 71 of the silicon controlled rectifier by the closing of the resonant reed member 23 which engages the contact 24, discharging the capacitor 27, the resultant current flow then charging the capacitor 30. The buildup of negative charge on the capacitor 30 is impressed on the gate 71 of the silicon controlled rectifier 70 and after a predetermined time interval the silicon controlled rectifier 70 will conduct feeding energy through the anode 72 and the cathode 73 at each half cycle of the A.C. input resulting in a pulsating D.C. current across the alarm coil 49. Capacitor 27 maintains a steady charging rate and substantially reduces the effects of the changing NEAR voltage input through the rectifier 25, which voltage produces the charging closure of the reed 23 against contact 24 as previously described.

FIG. 4 illustrates another preferred modification similar to FIG. 1 but in which the alarm relay 48 has been replaced by a silicon controlled rectifier 80, which is connected in series with the alarm coil 49 and comprises a gate 81, an anode 82 and a cathode 83.

In this circuit the transistor 41 acts as a shunt switch to the gate 81 of the silicon controlled rectifier 80. With

6

a negative bias on the base 42 of the transistor 41, the gate 81 of the rectifier 80 will be shunted to cathode 83 by the emitter 43 and collector 47 of transistor 41 and therefore will not conduct. When the negative bias with respect to the emitter 43 is removed from the base 42 of transistor 41, upon discharge of capacitors 27 and 30 as described with respect to FIG. 1, it will become positive with respect to the emitter 43 and the shunt switch action will be removed from the gate 81 to cathode 83 of the silicon controlled rectifier 80. The rectifier 80 will then conduct, providing a pulsating direct current to the clapper coil 49, sounding an audible alarm. The delaying circuit in this modification is identical to that described with reference to FIG. 1.

It is apparent that a PNP or NPN transistor could be used in place of the silicon controlled rectifier 80 without departing from the spirit of the invention. All that would be necessary would be to connect the clapper coil 49 in series with the emitter and collector circuit.

It is also apparent that although the various modifications have been shown utilizing a PNP transistor that this could be readily replaced by an NPN transistor for purposes of the invention. This replacement would only require that the charging polarities and biases be reversed from those described.

By utilizing solid state devices in the receivers of the present invention the problem of wear is substantially reduced and a life substantially longer than that required for the device has been insured. It is also to be noted that because the voltage potential across the capacitor 27 drops so rapidly during the first few cycles of oscillation of the reed member 23 the life of the reed contacts is greatly increased.

When the NEAR voltage signal is removed, the charge on capacitors 27-30 will rapidly recover. The NEAR receiver requirements specify that the receiver should not sound an alarm when subjected to a series of NEAR voltages 3.0 volts R.M.S. in amplitude for 50,000 cycles at 5 seconds on, 10 seconds off. The charge recovery of capacitors 27-30 is so rapid in relation to discharge rate that the present invention will not sound an alarm when subjected to 50,000 pulses of NEAR voltage 3.0 volts R.M.S. for 10 seconds on and only 5 seconds off, demonstrating that the time delay of the present device is exceptionally noncumulative.

Although we have described several embodiments of the present invention, it will be apparent to one skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. In an alarm system having a source of electrical power and means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,

(a) an alarm circuit including switching means and means producing an audible alarm upon actuation of said switching means,

(b) energization means operable to actuate said switching means after a predetermined time interval has elapsed from initial receipt of said actuation signal and including an energizing circuit and a time delay means,

(c) said energizing circuit being operable to activate said time delay means only upon receipt of said predetermined actuation signal,

(d) said time delay means being operable to actuate said switching means upon the lapse of a predetermined time interval after being activated by said energizing circuit,

(e) said time delay means including a first capacitor, a second capacitor, a blocking diode coupling said capacitors, electrical power means normally maintaining said capacitors in a charged state, means discharging said capacitors at a predetermined rate upon said delay means being activated and means actuat-

- ing said switching means when said capacitors have been discharged a predetermined amount, and
- (f) wherein said time delay means further comprises,
- (1) said first capacitor connected in parallel with said discharging means whereby upon receipt of said actuation signal said first capacitor is immediately discharged,
  - (2) means electrically connecting said first capacitor and said second capacitor, said blocking diode being disposed in said connecting means,
  - (3) means delaying the discharge of said second capacitor, and
  - (4) a control circuit operably connected to said switching means and responsive to the delayed discharge of said second capacitor for actuating said switch when said second capacitor has been discharged a predetermined amount.
2. The device as defined in claim 1 and in which said discharging means comprises
- (a) a resonant circuit including an electromagnetic device,
  - (b) a normally open discharge switch operable to be closed by said electromagnetic device only when said predetermined actuation signal is imposed on said resonant circuit,
  - (c) said discharge switch being electrically connected in parallel with said first capacitor whereby said first capacitor is immediately discharged upon closing of said discharge switch.
3. The device as defined in claim 1 and in which said discharging means comprises,
- (a) a resonant circuit including an inductor and a capacitor,
  - (b) a mechanically tuned resonant reed disposed within the magnetic field of said inductor and operable to oscillatingly respond to the predetermined actuation signal being imposed on said resonant circuit,
  - (c) a fixed contact member closely adjacent said reed and adapted to be contacted by said reed upon actuation thereof by said inductor,
  - (d) said reed and said contact member being electrically connected in parallel with said first capacitor whereby said first capacitor is immediately discharged upon contact of said reed with said contact member.
4. The device as defined in claim 1 and in which said discharging means comprises
- (a) a resonant circuit including an inductor and a capacitor,
  - (b) a mechanically tuned resonant reed disposed within the magnetic field of said inductor and operable to oscillatingly respond to the predetermined actuation signal being imposed on said resonant circuit,
  - (c) a contact member closely adjacent said reed and being contacted by said reed upon actuation thereof by said resonant circuit whereby said first capacitor is immediately discharged upon contact of said reed with said fixed contact.
5. The device as defined in claim 1 and in which said discharging means comprises,
- (a) a resonance circuit responsive to said predetermined actuation signal,
  - (b) a transistor having its base electrically connected with said resonance circuit and its emitter-collector side electrically connected with said first capacitor whereby said first capacitor is immediately discharged upon receipt of said actuation signal by said resonance circuit.
6. The device as defined in claim 5 and in which said time delay means further comprises a second transistor having its base electrically connected with said second capacitor and its emitter-collector output side operably connected with said switch whereby upon said second capacitor discharging to a predetermined value said sec-

ond transistor is operable to actuate said switch to sound an audible alarm.

7. In an alarm system having a source of electrical power and means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,

- (a) detector means which is responsive only to said predetermined actuation signal,
- (b) time delay means connected with said detector means,
- (c) a control circuit responsive to said time delay means,
- (d) alarm producing means operably connected with said control means,
- (e) said time delay means comprising a first capacitor, a second capacitor, a blocking diode coupling said capacitors, electrical power means normally maintaining said capacitors in a charged state, means discharging said capacitors at a predetermined rate upon said time delay means being actuated by said detector means and means delaying the discharge of said second capacitor with respect to the discharge of said first capacitor,
- (f) said last mentioned means including a transistor having its input base-emitter side connected to the said second capacitor and its emitter-collector output side connected to said control circuit,
- (g) said first capacitor being electrically connected to said source of electrical power,
- (h) said discharging means including a discharge switch responsive to said predetermined actuation signal being imposed on said detector means and being electrically connected in parallel with said first capacitor whereby said first capacitor is immediately discharged upon said detector means receiving said actuation signal, and
- (i) said first capacitor being electrically connected in parallel with said second capacitor whereby a discharge of said first capacitor initiates discharge of said second capacitor.

8. The device as defined in claim 7 and in which

- (a) said detector means comprises a resonant circuit operable to respond to said predetermined actuation signal and including a capacitor and an inductor,
- (b) said discharging means comprising a mechanically tuned resonant reed member disposed within the magnetic field of said inductor and an electrically insulated fixed contact member closely adjacent said reed member and operable to be engaged by said reed member upon said reed member being resonated by said inductor,
- (c) said first capacitor being connected electrically in parallel with said reed member and said fixed contact member.

9. The device as defined in claim 7 and in which said detector means comprising a resonant circuit operable to respond to said predetermined actuation signal and including a capacitor and an inductor,

- (b) said discharging means comprising a second transistor electrically connected to said resonant circuit to receive controlling voltage upon receipt by said resonant circuit of said predetermined actuation signal,
- (c) said second transistor also being electrically connected with said first capacitor.

10. In an alarm system having a source of electrical power and means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising

- (a) a detector means which is responsive only to said predetermined actuation signal,
- (b) a time delay means connected with said detector means to be actuated thereby when the predetermined signal is imposed on said electrical power,

- (c) a control circuit responsive to said time delay means,
  - (d) an alarm producing means actuated by said control circuit,
  - (e) said time delay means comprising a first capacitor, a second capacitor, a blocking diode coupling said capacitors, means charging said capacitors and means discharging said capacitors at a predetermined rate upon said time delay means being actuated by said detector means,
  - (f) said control circuit comprising a transistor having its input side connected to said second capacitor and being normally biased to provide non-conduction in the absence of input voltage,
  - (g) means producing an opposite polarity bias on said transistor to provide conduction through said transistor when input voltage other than said actuation signal is provided, and
  - (h) means including said first capacitor, said second capacitor and said blocking diode and operable to dissipate said opposite polarity bias at a predetermined rate upon receipt of a predetermined actuation signal.
- 11.** The device as defined in claim 10 and including
- (a) a silicon controlled rectifier having a gate electrically connected with said transistor, and
  - (b) said alarm producing means being electrically connected with said silicon controlled rectifier.
- 12.** In an alarm system having a source of electrical power and a means selectively imposing a predetermined actuation signal thereon, a delayed action device comprising,
- (a) a resonant circuit comprising an inductor and a capacitor electrically connected to form a series tuned L-C network,
  - (b) a mechanically tuned resonant reed disposed in the air gap of said inductor and adjusted to respond to said predetermined actuation signal,
  - (c) a fixed contact closely adjacent said reed to be engaged thereby and to produce a closed switch when said actuation signal is received,
  - (d) a first capacitor electrically connected in parallel with said switch,
  - (e) a second capacitor connected with said first capacitor and a blocking diode intermediate said capacitors,
  - (f) a transistor having an input electrically connected to said second capacitor,
  - (g) alarm producing means comprising an electromagnetic coil, a clapper actuated by said coil and a normally open relay having an armature operable upon being actuated to close said relay,
  - (h) an electromagnetic coil operable upon being energized and actuate said armature,
  - (i) said transistor having an output connected electrically in parallel with said second mentioned electromagnetic coil,
  - (j) means for charging said capacitors from said source of electrical power,
  - (k) means for discharging said first capacitor when said switch is closed, and
  - (l) means for causing delayed discharge of said second capacitor when said first capacitor is discharged.
- 13.** In an alarm system having a source of electrical power and a means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,
- (a) an electrically resonant circuit comprising an inductor and capacitor connected to form a series tuned L-C network,
  - (b) a first transistor having an output and having an input electrically connected to said resonant circuit,
  - (c) a first capacitor electrically connected in parallel with said output of said transistor,
  - (d) a second capacitor electrically connected to said first capacitor and a blocking diode intermediate said capacitors,

- (e) a second transistor having an output and having an input electrically connected to said second capacitor,
  - (f) a normally open relay electrically connected in parallel with said output of said second transistor,
  - (g) alarm sounding means operable to be actuated to sound an alarm when said relay is closed,
  - (h) means for charging said capacitors from said source of electrical power,
  - (i) means for discharging said first capacitor through the output circuit of said first transistor, and
  - (j) means for causing delayed discharge of said second capacitor when said first capacitor is discharged.
- 14.** In an alarm system having a source of electrical power and a means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,
- (a) an electrically resonant circuit comprising an inductor and a capacitor connected to form a series tuned L-C network,
  - (b) a first transistor having an output and having an input electrically connected with said resonant circuit,
  - (c) a first capacitor electrically connected in parallel with said first transistor,
  - (d) a second capacitor electrically connected with said first capacitor and a blocking diode intermediate said capacitors,
  - (e) a rectifying diode and a series voltage divider network connected with said capacitors,
  - (f) a second transistor having an output and having an input electrically connected to said second capacitor,
  - (g) a silicon controlled rectifier having a gate electrically connected to said output of said second transistor,
  - (h) alarm producing means comprising an electromagnetic coil electrically connected in series with said silicon controlled rectifier,
  - (i) means for discharging said first capacitor through the output circuit of said first transistor, and
  - (j) means for causing delayed discharge of said second capacitor when said first capacitor is discharged.
- 15.** In an alarm system having a source of electrical power and a means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,
- (a) an electrically resonant circuit comprising an inductor and a capacitor connected to form a series tuned L-C network,
  - (b) a resonant reed mechanically tuned to said predetermined actuation signal and disposed within the magnetic field of said inductor,
  - (c) a fixed electrical contact closely adjacent said reed and engaged thereby upon receipt of said actuation signal,
  - (d) a first capacitor connected electrically in parallel with said reed and said fixed contact whereby when said reed and said fixed contact are engaged said first capacitor is discharged,
  - (e) a second capacitor electrically connected with said first capacitor and a blocking diode intermediate said capacitors,
  - (f) a rectifying diode and a voltage divider network connected with said capacitors for normally charging said capacitors,
  - (g) a silicon controlled rectifier connected in series to said second capacitor through said voltage divider network,
  - (h) alarm producing means connected with said silicon controlled rectifier,
  - (i) means for causing delayed discharge of said second capacitor when said first capacitor is discharged.
- 16.** In an alarm system having a source of electrical power and a means selectively imposing a predetermined actuation signal thereon, a delayed action alarm device comprising,

11

- (a) an electrically resonant circuit comprising an inductor and a capacitor connected to form a series tuned L-C network,
- (b) a normally open switch means operable to be actuated to a closed position upon receipt of said predetermined actuation signal by said resonant circuit, 5
- (c) a first capacitor electrically connected in parallel with said switch,
- (d) a second capacitor electrically connected with said first capacitor and a blocking diode intermediate said capacitors, 10
- (e) a rectifying diode and a voltage divider network connected with said capacitors for normally charging said capacitors,
- (f) a silicon controlled rectifier having an anode and a cathode and having a gate connected with said second capacitor through said voltage network, 15
- (g) alarm producing means comprising an electromagnetic coil connected in series with said anode and said cathode of said silicon controlled rectifier, 20
- (h) means for causing delayed discharge of said second capacitor when said first capacitor is discharged.

12

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