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DUAL ACTUATION SIGNAL ALARM DEVICE

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FIG. 1.

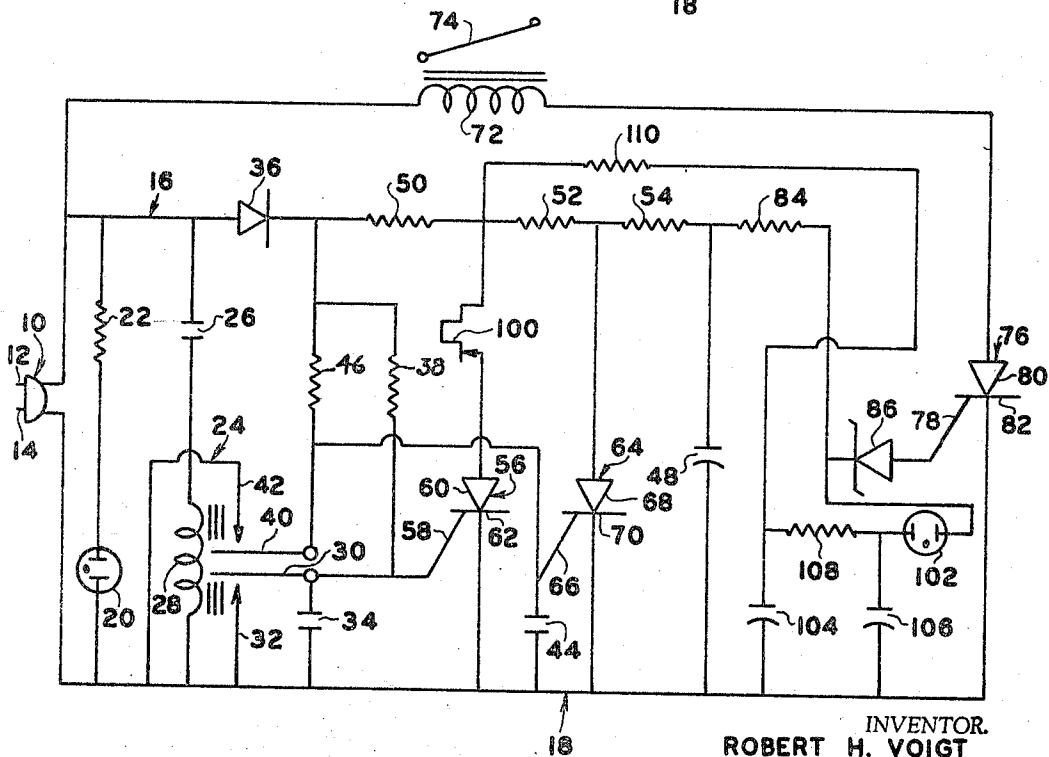
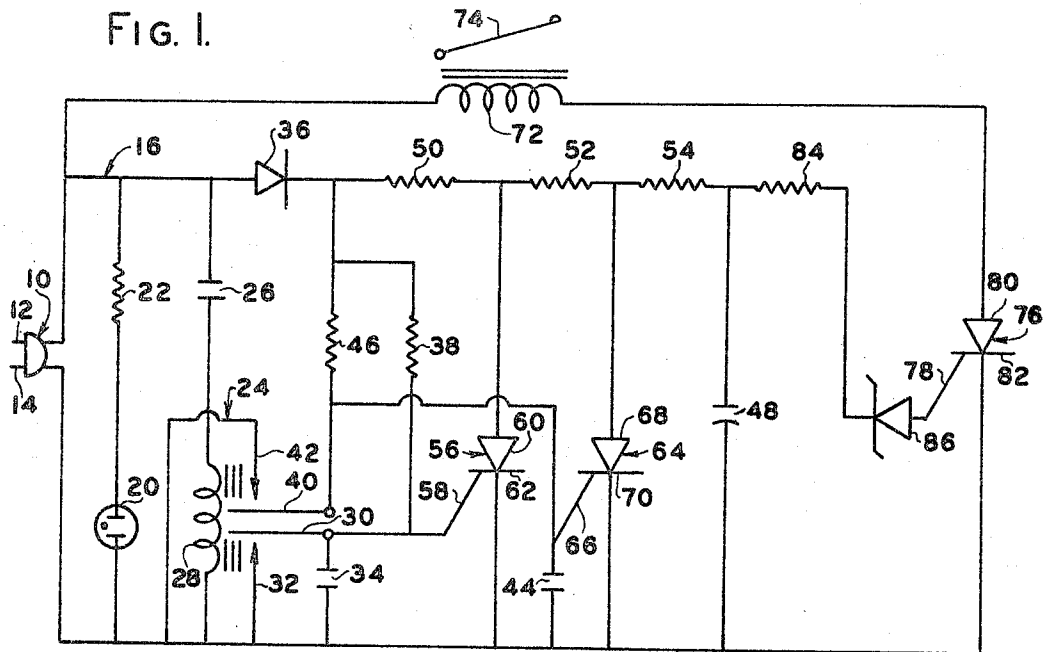


FIG. 2.

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DUAL ACTUATION SIGNAL ALARM DEVICE
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The present invention relates to electrical control circuits for producing an audible alarm, particularly to a receiving instrument for use as a component of the National Emergency Alarm Repeater (NEAR) system and more particularly to such a receiver and alarm device incorporating an improved false alarm prevention means.

The National Emergency Alarm Repeater (NEAR) system has been developed by the Office of Civil Defense to aid in alerting the nation of an impending enemy attack or other civil disaster. The system utilizes existing electric power lines to transmit an actuating signal of a controlled frequency and duration and which is superimposed on the 60 cycle per second electric power which is normally transmitted over the power lines. A receiver unit, plugged into an ordinary A.C. wall receptacle will respond with an audible alarm when activated by an actuation signal of sufficient duration.

One of the most difficult problems encountered in developing a receiver for such a system has been the problem of avoiding the effect which transient and accidental signals of the actuating frequency have on the receiver. It is important to insure against false alarms. To prevent accidental and transient signals from sounding an alarm, several safeguards have been heretofore built into the receiving component of the NEAR system. The receiving component must include means operable to delay sounding of the alarm until between 10 and 25 seconds after the actuation signal is received. In this way the alarm device rejects accidental signals which are of a duration of less than 10 seconds. Further, the time delay means must not be cumulative so that a series of short duration transient signals will not accumulate to sound a false alarm.

Copending applications Ser. Nos. 169,463 and 267,655 filed January 29, 1962 and March 25, 1963 respectively, disclose and claim receiving units which meet all of the requirements set forth by the Office of Civil Defense and especially those intended to prevent the sounding of false alarms. It has been found, however, that regardless of the time delay provided before the alarm will sound, false alarms can and are produced. Regardless of the delay and the frequency selected for actuation, the possibility exists that some man-made appliance or device on the line will produce a signal accidentally of a frequency and duration sufficient to sound an alarm.

The present invention provides a receiving component for the NEAR system which substantially reduces the problem of false alarms. To avoid false alarms, the device incorporates an alarm circuit which is actuated to produce a NEAR alarm only when the device receives substantially simultaneously two actuating signals of different frequencies. It is highly unlikely that such signals would be accidentally produced at the same time so that in all probability the time delay noncumulative requirements now in effect could be substantially reduced. Such a reduction would substantially lower the manufacturing costs of such devices.

A preferred modification of the present invention permits the receiving component to be used as an alarm for purposes in addition to its function as a NEAR alarm. The device of the preferred modification produces an uninterrupted audible alarm upon receipt of the dual actuating signals. Upon receipt of only one such signal for a predetermined time interval an interrupted alarm will be produced so that the receiver can be used to warn

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of local disasters or as a receiving component for a centrally actuated fire alarm. Further, one or more heat responsive switches can be incorporated into the circuitry to produce an interrupted audible alarm in the presence of a predetermined elevated temperature in the vicinity of the switches.

It is therefore an object of the present invention to improve emergency warning systems by providing a control circuit for such systems which is operable to actuate an audible alarm only upon the receipt substantially simultaneously of two different actuating signals.

It is a further object of the present invention to increase the versatility of receiving components for the NEAR system by providing circuitry for such a component operable to sound one alarm upon receipt thereof of two actuating signals and to sound an audibly distinguishable alarm upon receipt of only one of the actuating signals.

It is still a further object to improve such receivers by providing circuitry responding to an increased temperature to sound an alarm audibly distinguishable from the NEAR alarm.

Still further objects and advantages 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, and

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

Now referring to the drawings for a more detailed description of the present invention, FIG. 1 illustrates schematically a preferred receiving unit as comprising an input plug generally designated as 10, adapted for insertion into an ordinary A.C. wall receptacle (not shown), and having prongs 12 and 14 which are preferably connected to power lines 16 and 18 as shown. A neon lamp 20 and a current limiting resistor 22 are connected across the power lines 16 and 18. The neon lamp 22 indicates whether or not sufficient line voltage is present across the lines 16 and 18. A resonant circuit, generally indicated as 24 is connected across power lines 16 and 18, and preferably includes a capacitor 26 and an inductor 28. A first mechanical reed leaf member 30 and a first fixed contact member 32 are disposed within the magnetic field of the inductor 28 to form a discharge switch across a first capacitor 34. The first capacitor 34 is connected across lines 16 and 18 and is charged from a rectifying diode 36 through a resistor 38.

A second mechanical resonant reed leaf member 40 and a second fixed contact member 42 are also disposed within the magnetic field of the inductor 28 to form a discharge switch across a second capacitor 44. The second capacitor 44 is connected across lines 16 and 18 and is charged from the rectifying diode 36 through a resistor 46.

Leaf member 30 is mechanically tuned to resonate at a predetermined frequency passing through inductor 28 and which will hereinafter be called NEAR frequency No. 1. Upon receipt of NEAR frequency No. 1, the leaf member 30 will resonate at sufficient amplitude to engage fixed contact 32, thereby connecting a discharge path for capacitor 34. The leaf member 40 will resonate at a second predetermined frequency different from NEAR frequency No. 1 and hereinafter called frequency No. 2. Upon receipt of NEAR frequency No. 2, the leaf member 40 will resonate at sufficient amplitude to engage fixed contact 42, thereby connecting a discharge path for capacitor 44.

Capacitor 26 and inductor 28 form an electrically tuned series resonant circuit with the required bandwidth

to pass NEAR frequencies Nos. 1 and 2 with a minimum of attenuation.

A third capacitor 48 is connected across lines 16 and 18 through the rectifying diode 36 and resistors 50, 52 and 54.

A first silicon controlled rectifier 56 is provided with a gate 58, an anode 60 and a cathode 62. The anode 60-cathode 62 circuit of the rectifier 56 is series connected with the rectifying diode 36 and resistor 50 across lines 16 and 18 and shunts the capacitor 48. The gate 58-cathode 62 circuit of the rectifier 56 is series connected across lines 16 and 18 with the rectifying diode 36 and resistor 38 and shunts capacitor 34.

A second silicon controlled rectifier 64 is provided with a gate 66, an anode 68 and a cathode 70. The anode 68-cathode 70 circuit of the rectifier 64 is series connected with rectifying diode 36 and the resistors 50 and 52 across lines 16 and 18 and shunts the capacitor 48. The gate 66-cathode 70 circuit of the rectifier 64 is series connected across lines 16 and 18 with the rectifying diode 36 and resistor 46 and shunts capacitor 44.

An alarm circuit comprises a coil 72 connected across lines 16 and 18 on the A.C. side of rectifying diode 36. An armature clapper 74 is disposed within the magnetic field of the coil 72 and is operable upon energization of the coil 72 to strike the side of the control box (not shown) of the device to sound an audible alarm.

A silicon controlled rectifier 76 is provided with a gate 78, an anode 80 and a cathode 82. The anode 80-cathode 82 circuit of the rectifier 76 is series connected with the coil 72. The gate 78-cathode 82 circuit of the rectifier 76 is series connected across lines 16 and 18 with the rectifying diode 36, the resistors 50, 52 and 54, a resistor 84 and a zener diode 86.

In the absence of NEAR frequency No. 1, the contact members 30 and 32 will be open. The capacitor 34 will be fully charged and the voltage potential across the gate 58-cathode 62 of the rectifier 56 produced by the capacitor 34 will cause the anode 60-cathode 62 circuit to conduct to effectively shunt the junction between resistors 50 and 52 and therefore to prevent a voltage from appearing across resistor 54 and capacitor 48. With no voltage potential across capacitor 48, insufficient voltage will be impressed upon the gate 78 to cause the rectifier 76 to conduct through the anode 80-cathode 82 circuit and therefore the alarm coil 72 will remain deenergized.

Likewise in the absence of NEAR frequency No. 2 the contact members 40 and 42 will remain open and the charged capacitor 44 will cause the anode 68-cathode 70 circuit of the rectifier 64 to conduct to shunt capacitor 48 and to retain alarm coil 72 in a de-energized state.

It is clear that in the absence of either NEAR frequency No. 1 or No. 2, the coil 72 will remain de-energized so that if either is absent, no alarm can be sounded.

The presence of NEAR frequency No. 1 will cause capacitor 34 to discharge through closed contact members 30 and 32. The discharge of capacitor 34 will reduce the voltage potential across the gate 58-cathode 62 circuit of the silicon controlled rectifier 56 and the anode 60-cathode 62 circuit of the rectifier 56 will become non-conductive. This will remove the shunting action of rectifier 56 from capacitor 48 but unless the rectifier 64 is also in a non-conductive state with respect to its anode 68-cathode 70 circuit the capacitor 48 will not charge.

The presence of NEAR frequency No. 2 will cause capacitor 44 to discharge through closed contacts 40 and 42. The resultant decrease in the voltage impressed upon the gate 66 will cause the anode 68-cathode 70 circuit of the rectifier 64 to become non-conductive.

Thus in the simultaneous presence of both NEAR frequencies No. 1 and No. 2 the anode-cathode circuits of both rectifiers 56 and 64 will be in a state of non-conduction. This will remove the shunts from capacitor 48 and the capacitor 48 will charge through resistor 54 at a pre-

determined rate to therefore meet any time delay requirement of the final receiver specifications. When the voltage potential across capacitor 48 exceeds the breakdown voltage of the zener diode 86, the diode 86 will conduct impressing a sufficient voltage to the gate 78 of the silicon controlled rectifier 76 to produce a state of conduction across the anode 80-cathode 82 circuit to energize the coil 72 and to sound an audible alarm.

FIG. 2 illustrates another preferred embodiment of the present invention similar to the embodiment illustrated in FIG. 1, except that a normally closed heat responsive switch 100 is series connected with the anode 60-cathode 62 circuit of the silicon controlled rectifier 56. A neon lamp 102 is series connected with rectifier 36 and resistors 50, 52, 54, and 84 to shunt the zener diode 86. The lamp 102 is connected to power line 18 through parallel connected capacitors 104 and 106 and intermediate resistor 108. Line 16 is connected at a point intermediate the resistors 50 and 52 with the capacitors 104 and 106 through a resistor 110.

In the event of the presence of both NEAR frequencies No. 1 and No. 2, the embodiment illustrated in FIG. 2 operates identically with the operation of the embodiment described above with reference to FIG. 1 and produces a non-interrupted alarm as long as both frequencies are being received by the device.

In the event of fire or a sufficient rise in temperature within the vicinity of thermostatic switch 100, the switch 100 will open to remove the shunting effect of the silicon controlled rectifier 56. An increase in voltage potential will be produced intermediate the resistors 50 and 52 and the capacitor 104 will charge through resistor 110. The capacitor 48 will not become charged because of the continued shunting effect of silicon controlled rectifier 64. When capacitor 104 becomes charged, then capacitor 106 will begin to charge through resistor 108.

When the voltage across capacitor 106 reaches the ionization point of lamp 102, the lamp 102 will conduct providing sufficient gate current to gate 78 of silicon controlled rectifier 76 to produce conduction through the anode 80-cathode 82 circuit of the rectifier 76 and thereby energize the coil 72 to sound an alarm.

When the neon lamp 102 conducts, it discharges capacitor 106 so that the voltage potential across lamp 102 will drop below the ionization level of the lamp 102 and the lamp 102 momentarily becomes non-conductive. This forms a controlled pulse relaxation oscillator which results in an interrupting audible alarm which is readily distinguishable from the continuous alarm produced upon the simultaneous receipt of NEAR frequencies No. 1 and No. 2 by the device.

It is apparent that upon receipt of NEAR frequency No. 1, the device illustrated in FIG. 2 will sound an interrupting alarm since the silicon controlled rectifier 56 will become non-conductive and the circuit would function as though the switch 100 had warped open and as has been described above. This permits the embodiment of FIG. 2 to be used not only as a NEAR receiving component and an immediate vicinity sensing fire alarm but also permits it to be used to warn of local disaster or as a remote fire alarm component for a centrally actuated fire alarm system.

To prevent the premature sounding of an interrupted alarm when both NEAR frequencies are being received but have not yet actuated the alarm capacitor 104 and resistors 50 and 110 have a longer time constant than capacitor 48 and series resistors 50, 52 and 54.

It is clear that the silicon controlled rectifiers of the circuits of the present invention could be readily replaced by other suitable three element solid state switching means such as an NPN or PNP transistor.

It is apparent that the present invention substantially improves the receiving components for the NEAR system. The difficulty of finding a line frequency which is completely free from noise of a duration longer than the

time delay built into the receiver in all areas of the country has been solved. The use of an alarm system having two actuation signals substantially reduces the possibility of this difficulty occurring because of the requirement of simultaneous receipt of the selected signals. Not only is the possibility of false alarms substantially reduced, but also the time delay requirements of the device can be relaxed to substantially reduce the cost of producing the device.

It is also apparent that although I have described but several embodiments of the present invention, many other changes and modifications can be made without departing from the spirit of the invention as expressed by the appended claims.

I claim:

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

- (a) an alarm circuit including switching means and means producing an alarm upon actuation of said switching means,
- (b) means operable to actuate said switching means and including a first control circuit, a second control circuit, an actuating circuit and a charging source for said actuating circuit,
- (c) said actuating circuit being operable to actuate said switching means upon a predetermined increase in the voltage potential across said actuating circuit,
- (d) said first control circuit normally shunting said actuating circuit with respect to said charging source and including means removing the shunt effect of said first control circuit from said actuating circuit only upon receipt of said first actuation signal,
- (e) said second control circuit normally shunting said actuating circuit with respect to said charging source and including means removing the shunt effect of said second control circuit from said actuating circuit only upon receipt of said second actuation signal,
- (f) a third control circuit connected with said actuating circuit and including means operable to increase the voltage potential across said actuating source independently of said potential source to produce said alarm upon receipt of said first actuation signal, and
- (g) said third control circuit including means intermittently reducing said voltage potential across said actuating circuit whereby the alarm produced by said third control circuit is an interrupted alarm.

2. The system in claim 1 and in which said third control circuit includes a heat responsive means operable to increase the voltage potential across said actuating circuit to produce said alarm upon the presence of a predetermined temperature in the vicinity of said heat responsive means.

3. The system defined in claim 1 and including

- (a) a first time delay means connecting said first and second control circuits with said actuating circuit and being operable to delay the increase in voltage potential across said actuating circuit for a predetermined time interval after receipt of said actuation signals, and
- (b) a second time delay means connecting said third control circuit and said actuating circuit and being operable to delay the increase of voltage potential across said actuating circuit produced by said third control circuit for a predetermined time interval after receipt of said first actuation signal.

4. The system as defined in claim 3 and in which said second time delay means delays increasing the voltage potential across said actuating circuit for a longer predetermined time period than the delay produced by said first time delay means.

5. In an alarm system having a source of electrical power and means selectively imposing a first and a second

predetermined actuation signal thereon, an alarm device comprising

- (a) an alarm circuit including switching means and means producing an alarm upon actuation of said switching means,
- (b) an actuating circuit operable upon receiving a predetermined electrical charge from a charging source to actuate said switching means,
- (c) a first control circuit including a normally closed switch shunting said actuating circuit with respect to said charging source and means responsive to the presence of said first actuation signal to open said switch and remove the shunt of said first control circuit from said actuating circuit,
- (d) a second control circuit including a normally closed switch shunting said actuating circuit with respect to said charging source and means responsive to the presence of said second actuation signal to open said last mentioned switch and remove the shunt of said second control circuit from said actuating circuit,
- (e) a third control circuit connected with said actuating circuit and including means charging said actuating circuit independently of said charging source upon receipt of said first actuation signal, and
- (f) said third control circuit including means intermittently decreasing said electrical charge from said third control circuit to said actuating circuit whereby the alarm produced by said third control circuit is an interrupted alarm.

6. The device as defined in claim 5 and in which said third control circuit includes a heat responsive switch member and means operable to charge said actuating circuit upon said switch being heated to a predetermined temperature.

7. The device as defined in claim 5 and including

- (a) a first time delay means connected intermediate said first and second control circuits and said actuating circuit and being operable to delay charging of said actuating circuit for a predetermined time interval after receipt by said first and second control circuits of said actuation signals, and
- (b) a second time delay means connected intermediate said third control circuit and said actuating circuit and being operable to delay charging of said actuating circuit for a predetermined time interval after receipt by said third control circuit of said actuation signal.

8. The device as defined in claim 7 and in which said second time delay means is operable to delay charging of said actuating circuit for a period of time longer than the period of delay produced by said first time delay means.

References Cited by the Examiner

UNITED STATES PATENTS

2,361,653	10/1944	Roberts	325—364 X
2,388,576	11/1945	Seeley	340—310
2,437,876	3/1948	Cohn	340—384 X
2,591,937	4/1952	Herrick	340—171
3,022,498	2/1962	Alcott	340—384 X
3,076,185	1/1963	Ida	
3,130,369	4/1964	Beaton	340—310 X
3,148,365	9/1964	Voight	340—310
3,153,176	10/1964	Clay	317—142 X
3,174,143	3/1965	Akin	340—276 X

OTHER REFERENCES

Bramley: Radio, June 1942, pp. 15, 16, 34.

Voss: Electronics, February 1943, pp. 100, 102, 104, 106.

NEIL C. READ, *Primary Examiner*.

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