

Sept. 13, 1966

B. F. CRAIG

3,273,069

CONELRAD WARNING DEVICE

Filed Nov. 8, 1961

2 Sheets-Sheet 1

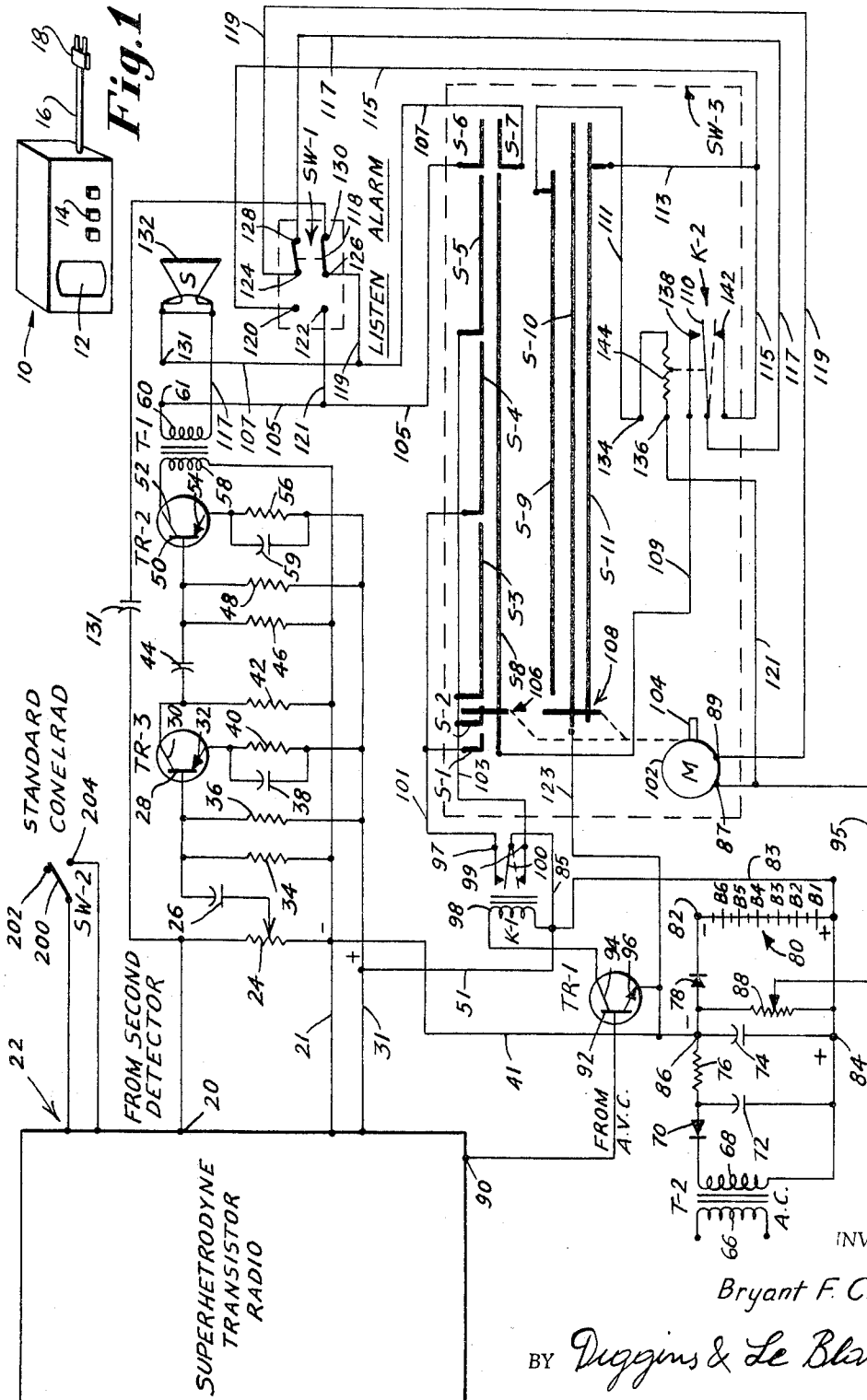


Fig. 2

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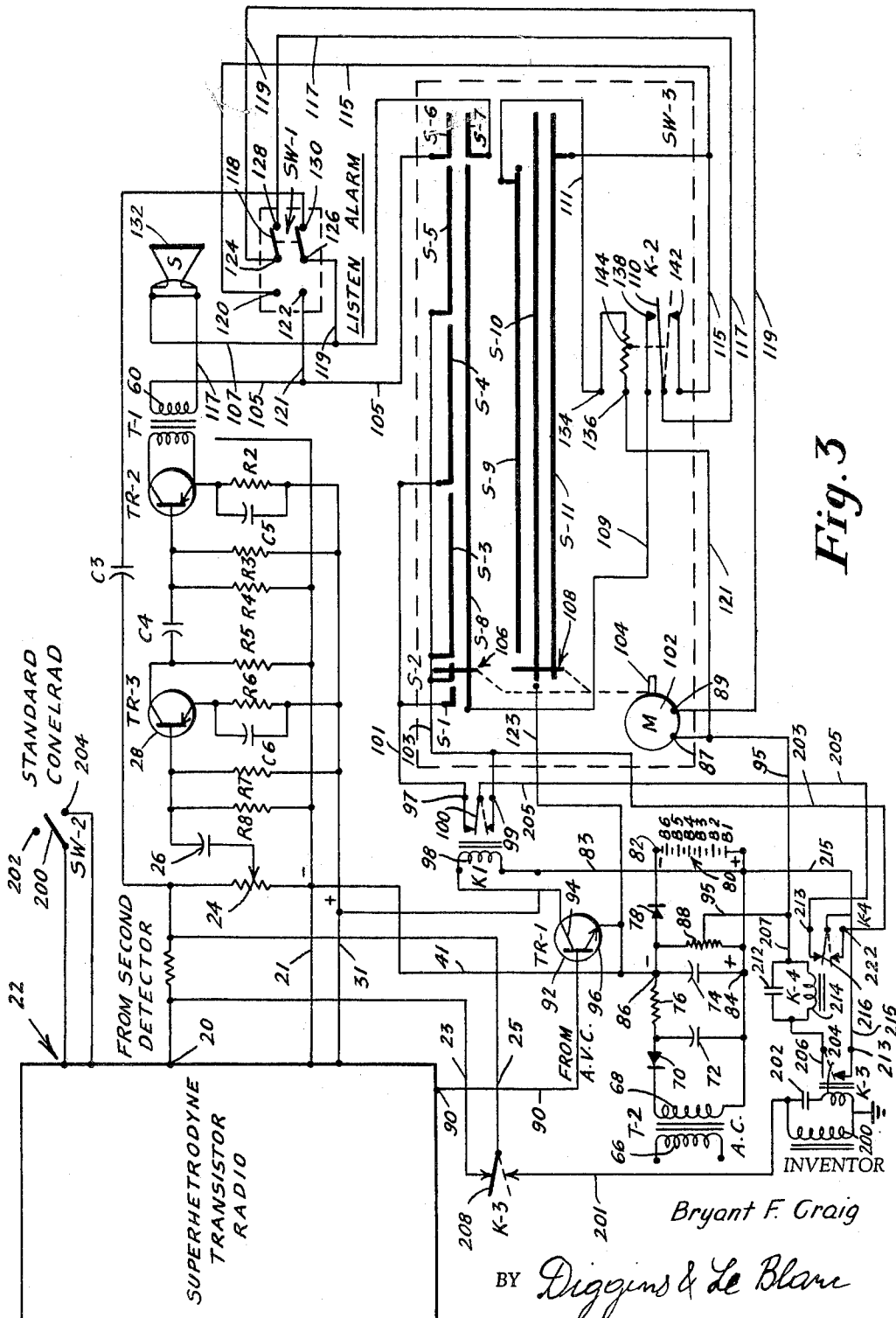
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CONELRAD WARNING DEVICE

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Filed Nov. 8, 1961, Ser. No. 151,035
8 Claims. (Cl. 325—466)

This invention relates to a warning device and more particularly to a radio receiver warning device for developing and delivering an audible warning of a conelrad alert.

More specifically, the present invention relates to an electronically actuated signal decoding apparatus, the operation of which is dependent upon the reception of radio frequency signals transmitted pursuant to and in accordance with the standard conelrad warning system.

The instant apparatus may be used in applications where an alerting signal of the predetermined conelrad code actuates a decoding portion of the apparatus which in turn causes a standard superheterodyne transistorized radio receiver to be actuated so as to render a signal reproducing device operative and thereby result in an audible announcement of an impending and imminent national emergency.

The instant apparatus may be also used in conjunction with the predetermined NEAR code which is transmitted over pre-existing power transmission lines and networks.

In the past numerous devices and systems capable of providing radio warnings of an impending disaster, such as, an air raid, hurricane and tornado warnings, police alerts, or fire warnings, have been developed and are known in corresponding technical and scientific areas. None of these systems, however, are suited for use in conjunction with the standard conelrad system.

In general, most of the prior known devices and systems require highly complicated equipment and unreasonably expensive circuit components for performing the purpose for which the devices were created.

Further, most of the heretofore known radio warning systems relied principally upon the fact that, in the event of a national emergency, modulation of the broadcast carrier frequency of standard transmitting stations would cease, thereby causing signalling means, such as lights, buzzers, bells, etc., to be activated. Such systems, however, are not practical nor effective since there are often circumstances when standard transmitting stations transmit only a carrier wave for short periods of time. It is apparent, therefore, that under such conditions systems operating on the above-mentioned principle would emit false alarms.

Still further, since it is obviously desirable to quickly alert the populace and instruct them on the proper course of action to be taken in the event of a national emergency, many of the heretofore known systems have suggested the use of centrally located loudspeakers. However, an obvious disadvantage regarding centrally located loudspeakers is that a sizeable portion of the populace may not hear the emergency because of their physical location in respect to the loudspeakers.

Still further, most of the heretofore known radio warning systems and devices required specific and cumbersome procedures for attachment thereof to existing superheterodyne radio receivers commonly found in civilian, industrial and governmental sites. Such arrangements were often objectionable in that the normal operation or use of the radio receiver was impaired or the cost for connecting the device or system thereto was considerable.

Still further, most of the prior known radio warning systems or devices were unreliable, ineffective and inefficient in performing the function intended should the

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commonly available 110 volt, 60 cycle, A.C. power supply be disconnected. That is to say, the receipt of a warning of an impending disaster or the like was not perfected in the event that conventional A.C. power commonly available in this country were to be disconnected for one reason or the other.

The present invention avoids the above set forth difficulties by providing a simplified and inexpensive unit useable in civilian, industrial or governmental sites to give an audible indication of a national emergency and which device is particularly suited for use in conjunction with the standard conelrad system as well as the standard NEAR system.

While the present invention may be used in a variety of civilian, industrial and governmental applications, the principle of operation makes it particularly useful for the unattended reception and decoding of conelrad code signals. Accordingly, the present invention may be used for civil defense purposes by the general public, by operators of radio broadcasting equipment and by commercial, industrial or amateur services which are presently required by law to have available decoding equipment in order that radio broadcasting, except for civil defense purposes, may be discontinued during a national emergency.

Still further, the heretofore known radio warning systems have required the continuous operation of the entire warning device, whereas, the device and principles of the present invention permit conventional superheterodyne transistorized radio receivers to be uniquely modified so as to receive and decode conelrad alerts and yet not require the continuous full operation of the apparatus, thereby resulting in a noticeable economy of operation.

Accordingly, a primary object of the present invention is to provide a novel and unique radio warning device capable of civilian, industrial and governmental use.

Another object of the present invention is to provide a unique system for developing and delivering audible warnings of a national emergency.

A further object of the present invention is to provide a simplified receiving unit for civilian, industrial or governmental use for developing audible warnings of a national emergency.

A still further object of the present invention is to provide a radio warning device particularly suited for use in conjunction with the existing conelrad warning system.

A still further object of the present invention is to provide a novel radio warning device which is capable of delivering an audible warning of a national emergency notwithstanding the destruction or discontinuance of conventional A.C. power commonly used by radio receivers in this country.

A still further object of the present invention is to provide a unique emergency warning device capable of responding to the existence of either a conelrad warning signal or a NEAR warning system.

A still further object of the present invention is to provide a unique warning device which is capable of receiving conelrad or NEAR signal code and yet does not require the continuous full operation of the apparatus thereby resulting in economy of operation.

A still further object of the present invention is to provide a novel warning device whereby a conelrad or NEAR emergency signal code actuates a decoding portion of the device which in turn causes the receiver portion of the device to be actuated thereby giving an audible warning of an impending national emergency.

A still further object of the present invention is to provide a warning device wherein a continuously operating, unattended, decoding circuit thereof is responsive to the conelrad or NEAR signal code and which circuit auto-

matically actuates an alerting circuit thereby resulting in an audible warning of an impending national disaster.

A still further object of the present invention is to provide a novel emergency warning device particularly suited for use in conjunction with the existing conelrad or NEAR warning systems which is simple in construction, economical to manufacture, and highly reliable in performing the function intended.

These and further objects and advantages of the invention will be more apparent upon reference to the following specification, claims and appended drawings wherein:

FIGURE 1 is a perspective view of the warning device of the present invention;

FIGURE 2 is a detailed circuit diagram of the novel portion of the radio warning device of the present invention; and

FIGURE 3 is a detailed circuit diagram of a modification of the novel portion of the radio warning device of the present invention.

Copending application Serial No. 123,469, filed July 12, 1961, now Patent No. 3,121,841, in the names of Craig and McCartney, discloses a warning device for use in the home which warning device takes the form of a small portable transistor radio receiver. The present invention relates to a warning device of the type disclosed in said copending application but provides a mechanical decoder portion for uniquely responding to the conelrad or NEAR warning systems and for rendering such device capable of emitting an audible warning of an impending and imminent national emergency.

While the present invention will be described hereinbelow in conjunction with, and is particularly suited for, use with the existing conelrad radio warning system, or the existing NEAR transmission line warning system, the present invention has utility in conjunction with other emergency warning purposes, such as, general broadcast information, tornado, hurricane, fire, and other disaster alerts.

In the event of any enemy bomber or missile attack, it is well known that the general public will have very little warning, and will have only a short time to take cover, evacuate and to make other arrangements essential to their survival during such enemy attack. The time after a general warning, and before attack, has been estimated by the experts to be merely a matter of minutes, and even the most optimistic estimates consider 45 minutes to be the greatest possible warning time that present known warning systems are able to provide to the general public.

While conventional air raid warning sirens to some extent provide a useable general warning system, they have many undesirable features, among which may be listed the high expense of installation and upkeep, along with the periodic disturbance and annoyance to the public when the sirens are tested or inadvertently actuated.

The novel and unique warning device of the present invention may be incorporated in a small container in the form of a small transistor radio receiver, and removably plugged into the conventional A.C. power supply outlet found in most civilian, industrial and governmental sites.

When a predetermined series of warning signals are transmitted from local radio stations or from local public and private utilities during a conelrad or NEAR alert, respectively, the device of the present invention is actuated and it amplifies the audio tone signal transmitted by either warning system. The amplification of the audio tone signal provides sufficient volume thereof so that it can be heard throughout the owner's site, and the device is operative throughout an entire 24 hour day on an automatic basis, so that it does not depend upon the owner having his radio turned on and will operate to warn the public even during the night when most are asleep.

Referring to FIGURE 1, the warning device of one modification of the present invention comprises a modified radio receiver generally indicated at 10, which is approxi-

mately the size of a transistor radio receiver and includes a speaker 12, three button switch 14, and a cord 16 leading to a plug 18 for insertion in the conventional 110 volt, 60 cycle outlet commonly available in this country.

The warning device of the present invention includes the conventional RF antenna for receiving broadcast transmissions over the commercial AM or FM broadcast bands, in connection with FIGURE 2, and the conventional transmission lines and networks commonly found in this country in connection with FIGURE 3, as well as conventional radio receiver RF and first IF stages, all of which are omitted from FIGURES 2 and 3 for the sake of clarity and understanding.

Referring now to FIGURE 2, wherein the device of the present invention for use in conjunction with the conelrad system is shown, the terminal 20 receives the output from the second detector of a conventional superheterodyne transistor radio generally indicated at 22. The audio output signal from the second detector is developed across resistor 24 and then fed through capacitor 26 into the base of transistor TR-3. The signal delivered to the base 28 of transistor TR-3 is developed across resistor 34 which has one end connected to the base 28 and the other end connected to the B— potential line 21. The collector 30 of transistor TR-3 is connected to the junction of capacitor 44 and resistor 42. The emitter 32 of transistor TR-3 is connected to the upper junction of parallel connected capacitor 38 and resistor 40. The lower junction of capacitor 38 and resistor 40 is connected to the B+ potential line 31. A conventional biasing resistor 36 is connected at one end to the base 28 and the other end to the B+ potential line 31. The other end of resistor 42 is connected to the B— potential line 21. The audio signal developed across the resistor 42 is A.C. coupled through capacitor 44 to the base 50 of transistor TR-2 and is developed across resistor 46 which has one end connected to base 50 and the other end connected to the B— potential line 21. A biasing resistor 48 is coupled at one end to base 50 and the other end to the B+ potential line 31. The collector 52 of transistor TR-2 is connected to the upper terminal of primary 58 of output transformer T-1. The lower terminal of primary 58 is connected to the B— potential line 21. The emitter 54 of transistor TR-2 is connected to the upper junction of parallel connected capacitor 59 and resistor 56. The lower junction of parallel connected capacitor 59 and resistor 56 is connected to the B+ potential line 31. The output audio signal is then developed across the primary 58 of output transformer T-1, and inductively coupled to the secondary 60 of that transformer.

Referring now to the lower portion of FIGURE 2, wherein the decoder portion of the present invention is shown, the direct current operating potentials necessary in the device of the present invention are developed from a standard A.C. main current supply. The A.C. energy is coupled across transformer T-2 to rectifier 70 and smoothing capacitors 72 and 74. The transformer T-2 is adapted to inductively couple six or seven volts to rectifier 70. The six or seven volts coupled by transformer T-2 is rectified by rectifier 70 and smoothed by capacitors 72 and 74 and limiting resistor 76. A six-volt stand-by battery, generally indicated at 80 is provided but this battery is disconnected from the circuit by reason of the rectifier 78 which blocks the negative terminal 82 from being connected to the B— potential terminal 86. The lower terminals of the secondary 68 and capacitors 72 and 74 are each connected to the B+ supply terminal 84. The B— supply terminal 86 is connected through lead 41 to the B— supply line 21 and the B+ supply terminal 84 is connected through lead 51 to the B+ supply line 31.

It is to be noted, that since the voltage at B— supply terminal 86 is a greater negative voltage than the negative

voltage at terminal 82, the rectifier 78 is back-biased. This prevents the stand-by battery 80 from being connected into the device of the present invention. Should the A.C. main current supply be disconnected for any reason, the rectifier 78 will be forward-biased since the terminal 86 would momentarily rise to ground potential and the stand-by battery 80 would be effectively connected across terminals 86 and 84. The isolation of stand-by battery and the coupling of the battery into the circuit only when the A.C. main current supply is removed provides an automatic conversion of the power supply from half-wave rectified A.C. to stored D.C.

Thus, it will be seen that the operation of the device of the present invention does not rely upon the existence of A.C. voltage. Further, the isolation of stand-by battery 80 permits the battery to be used for longer periods of time since there is no drain of the energy stored therein until the A.C. main current supply is removed.

The signal from the superheterodyne transistor radio 22 used to actuate the decoder portion of the device of the present invention is the automatic volume control (AVC) voltage signal which is commonly available in standard superheterodyne radio receivers. The AVC voltage signal from the receiver is connected to terminal 90 and then fed to the base 92 of transistor TR-1. The collector 94 of transistor TR-1 is connected to the upper end of coil 98 of relay K-1. The lower end of coil 98 is connected to B+ potential terminal 84 via lead 83. The emitter 96 of transistor TR-1 is connected to the B- potential terminal 86. When the radio receiver is receiving carrier modulated signals, the AVC voltage fed to the base 92 of transistor TR-1 is sufficient to cause transistor TR-1 to be cut-off or in a non-conducting condition. That is to say, when the radio receiver receives carrier modulated signals, the AVC voltage becomes sufficiently negative so as to bias the transistor into its normally non-conducting condition. Thus, relay K-1 will be de-energized and swinger 100 of that relay will be as shown in FIGURE 2. Accordingly, in the absence of carrier modulated signals relay K-1 will be energized and swinger 100 of that relay will move to the position shown by the dotted lines. The relay K-1 is a single pole double-throw relay and the effect of the movement of swinger 100 of that relay will be discussed more fully hereinbelow.

The motor 102 is a small D.C. motor which operates at a speed of 3000 revolutions per minute when 4½ volts D.C. is applied thereto. The motor is geared down approximately 5:1 and therefore gives out an output of approximately 600 r.p.m.'s at its output shaft 104. The output shaft 104 of motor 102 is connected to the shorting bars 106 and 108 of the printed wiring board switch SW-3. By way of example, the shaft 104 of motor 102 may be coupled to a lead screw (not shown) that has 32 threads per inch. The lead screw is conventionally coupled to shorting bars 106 and 108 and drives the bars.

The printed wiring board switch SW-3 contains a plurality of conductor strips S-1 to S-11. Thus, as the shorting bars 106 and 108 sweep from left to right or right to left under the control of motor 102, the conductor strips are shorted thereby. As shown in FIGURE 2, conductor strips S-1 and S-4 are each connected to lead 101, which is connected to contact 97 of relay K-1. Conductor strips S-2, S-3, and S-5 are each connected to lead 103 which is connected to contact 99 of relay K-1. Conductor strip S-6 is connected to lead 105 which is connected to the terminal 61 of secondary 60 of output transformer T-1 and to terminal 122 of switch SW-1. Conductor strip S-7 is connected to lead 107 which is connected to the terminal 131 of the speaker 132 and to terminal 126 of the switch SW-1. Conductor strip S-8 is connected to lead 109 which is connected to contact 138 of relay K-2. Conductor strip S-9 is connected to lead 111 which is connected to terminal 134 of relay K-2. Conductor strip S-10 is connected to lead 123 which is

connected to the B- potential terminal 86. Conductor strip S-11 is connected to lead 113 which is connected to lead 115. Lead 115 is connected to contact 142 of relay K-2 and terminal 120 of switch SW-1. Swinger 110 of relay K-2 is connected to lead 117 which is connected to terminal 128 of switch SW-1.

The relay K-2 is a thermal delay relay which takes approximately 20 to 25 seconds for its swinger arm 110 to move from the position shown in FIGURE 2 to the position shown by the dotted lines, after voltage is applied across terminals 134 and 136 of that relay. The resistor 144 of relay K-2 has one end connected to terminal 134 and the other end connected to terminal 136. When voltage is applied across terminals 134 and 136, and current flows through resistor 144, resistor 144 will heat up and thereby cause swinger 110 to move to the position shown by the dotted lines. As above mentioned, it takes approximately 20 to 25 seconds for swinger 110 of relay K-2 to switch positions after voltage is applied across terminals 134 and 136.

Referring now to the upper righthand corner of FIGURE 2, there is shown switch SW-1 which is a double pole, double throw switch having a parallel swinger 118 which connects terminal 124 to terminal 128 and terminal 126 to terminal 130 when in one position and connects terminal 124 to terminal 120 and terminal 126 to terminal 122 when in the other position. The above-mentioned first and second positions of switch SW-1 will be hereinafter referred to as the ALARM and the LISTEN positions, respectively.

Cycle of operation

A cycle of operation of the device of FIGURE 2 in accordance with the present invention is as follows: It is to be understood, however, that the device of FIGURE 2 is designed to detect the conelrad code signal, which consists of a standard broadcast station carrier being OFF five seconds, ON five seconds, OFF five seconds, modulated with a 1000 cycle audio signal (ON) for fifteen seconds, then followed by an audio modulation of the carrier for an indefinite period (ON), which gives specific data and information pertaining to the disaster which motivated the radio alert. The decoder portion of this device utilizes only that portion of the conelrad signal which consists of the five second intervals of presence and absence of standard broadcast station carrier waves. Thus, since the device does not utilize the audio portion of the conelrad code, the audio output of the device will be muted, that is to say, there will be no output coming from the speaker 132 until the device detects the carrier wave portion of the conelrad code. Accordingly, the device of the present invention will connect the speaker 132 to the output of the transistor radio only after the three five second periods of conelrad code so as to cause the speaker to emit a very harsh buzzing tone.

Assuming now that shorting bars 106 and 108, contacts 100 of relay K-1, swinger 110 of relay K-2, and swinger 118 of switch SW-1, are each in the position shown in FIGURE 2.

Assuming further that the broadcast station carrier wave is not being transmitted and picked up by the transistor receiver, i.e., as is the case during the first five second period of the conelrad code, transistor TR-1 conducts thereby energizing coil 98 of relay K-1 and moving swinger 100 to the position shown by the dotted lines. Thus, an energizing potential is connected to motor 102 through the path including B+ terminal 84, lead 83, lead 85, swinger 100, contact 99, lead 103, conductor strip S-2, shorting bar 106, conductor strip S-8, lead 109, contact 138, swinger 110, lead 117, terminal 128, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B+ terminal 84. Therefore, the motor 102 is caused to run thereby turning shaft 104 which causes shorting bars 106 and 108 to move toward the right end of switch SW-3.

If coil 98 of relay K-1 remains energized for a minimum period of three seconds, the shorting bar 106 will reach conductor strip S-4 and shorting bar 108 will be engaging conductor strips S-9, S-10 and S-11.

When shorting bar 106 contacts conductor strip S-4 the motor 102 is caused to stop since energizing voltage to the motor is disconnected and since swinger 100 of relay K-1 is in the position shown by the dotted lines. That is to say, tracing the path from B+ terminal 84, lead 83, lead 85, contact 99, swinger 100, and lead 103, it will be noted that positive voltage is not connected to conductor strip S-4 from lead 103, but is coupled thereto by lead 101 which is connected to contact 97 of relay K-1. Thus, the energizing potential will not be supplied to the motor 102 when shorting bar 106 engages conductor strip S-4 until swinger 100 of relay K-1 is in the position shown in FIGURE 2.

During the next five second period of the conelrad code, i.e., the five second carrier ON period, the transistor TR-1 returns to its normally non-conducting state and coil 98 of relay K-1 is de-energized thereby causing swinger 100 to return to its normal position as shown in FIGURE 2. When the swinger 100 returns to the position shown in FIGURE 2, an energizing potential is again supplied to the motor 102 through the path including B+ terminal 84, lead 83, lead 85, swinger 100, contact 97, lead 101, conductor strip S-4, shorting bar 106, conductor strip S-8, lead 109, contact 138, swinger 110, lead 117, terminal 128, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B+ terminal 84. The motor will again drive the shorting bars 106 and 108 further toward the right end of switch SW-3. If the coil 98 of relay K-1 remains de-energized for a minimum period of three seconds the shorting bar 106 will reach conductor strip S-5 and shorting bar 108 will remain in engagement with conductor strips S-9, S-10 and S-11. When shorting bar 106 contacts conductor strip S-5, the motor 102 is again caused to stop since conductor strip S-5 is connected to the B+ terminal 84 through relay K-1 only when swinger 100 is in the position shown by the dotted lines.

When the carrier wave again goes OFF, i.e., as is the case during the third five second period of the conelrad code, energizing voltage will again be supplied to the motor 102, since transistor TR-1 again conducts and energizes relay K-1 so that swinger 100 of that relay is again caused to move to the position as shown by the dotted lines. The energizing potential for motor 102 is again provided via the path including B+ terminal 84, lead 83, lead 85, swinger 100, contact 99, lead 103, conductor strip S-5, shorting bar 106, conductor strip S-8, lead 109, contact 138, swinger 110, lead 117, terminal 128, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B+ terminal 84. Motor 102 again further drives shorting bars 106 and 108 towards the right end of switch SW-3. If the carrier wave remains OFF for at least three seconds, the shorting bar 106 reaches conductor strips S-6 and S-7. When the shorting bar 106 shorts conductor strips S-6 and S-7, the terminal 61 of secondary 60 of output transformer T-1 is coupled to terminal 131 of speaker 132, thereby permitting the output signal of transistor TR-2, which is developed across the primary 58 of output transformer T-1, to be inductively coupled to the speaker 132. Therefore, the 1000 cycle modulated carrier wave transmitted during the fourth period of the conelrad code is detected by the transistor receiver, amplified by transistors TR-3 and TR-2, and reproduced by speaker 132.

It will be recalled that the switch SW-1 is in the ALARM position and that the shorting of conductor bars S-6 and S-7 by shorting bar 106 also couples the terminal 61 of secondary 60 of output transformer T-1 to feedback capacitor 131 which is coupled to the base 28 of transistor TR-3 through resistor 24 and capacitor 26. Thus, the 1000 cycle tone developed across the sec-

ondary 60 of transformer T-1 is regeneratively fed back through terminal 61, lead 105, conductor strip S-6, shorting bar 106, conductor strip S-7, lead 107, lead 119, terminal 126, terminal 130, capacitor 131, resistor 124 and capacitor 26 to base 28 of transistor TR-3 to further enhance and increase the volume of the 1000 cycle tone or the loud buzzing tone reproduced by the speaker 132. The 1000 cycle tone will continue until switch SW-1 is switched to the LISTEN position.

When switch SW-1 is moved to the LISTEN position, a negative energizing voltage is supplied to the motor 102, thereby causing the motor to run in the opposite direction, i.e., to move the shorting bars 106 and 108 to the left end of switch SW-3. This energizing voltage is delivered to the motor 102 through the path including B- terminal 86, lead 123, conductor strip S-10, shorting bar 108, conductor strip S-11, lead 113, lead 115, terminal 120, terminal 124, lead 119, terminal 89, terminal 87, resistor 88, back to B- terminal 86. The motor will continue to drive the shorting bars 106 and 108 toward the left end of switch SW-3 until the shorting bar 108 no longer contacts conductor strips S-10 and S-11. The motor is thereby caused to stop since the above mentioned negative energizing potential is no longer supplied to the motor 102 through the path above set forth. When the switch SW-3 is in this position, the shorting bar 106 engages the conductor strip S-1 and S-8. The device will remain in this position so long as switch SW-1 remains in the LISTEN position.

So long as switch SW-1 is in the LISTEN position, the speaker 132 remains connected to the secondary 60 of transformer T-1 through the path including swinger 118, terminal 126, lead 119, lead 107, speaker 132, lead 117, secondary 60, terminal 61, lead 105, lead 121, terminal 122, back to swinger 118. Therefore, the audio output from transistor TR-2 which is developed across primary 58 of output transformer T-1 is inductively coupled to the speaker for reproduction. Accordingly, when the switch SW-1 is moved to the LISTEN position, any information of instructions which follows the conelrad code may be heard and appropriate action may then be taken pursuant to such instructions or information.

It is important to note, that under the present conelrad warning system all standard broadcast station transmitters are caused to transmit in accordance with the conelrad code, to wit, five seconds OFF, five seconds ON, and five seconds OFF, carrier wave modulated with a 1000 cycle signal for a period of fifteen seconds, then followed with the above mentioned instructions and information period. At this time, the device may now be switched into the conelrad wave length by moving switch SW-2 so that the swinger 200 engages the terminal 204. The movement of switch SW-2 automatically couples a trimmer capacitor, or an inductor or both, into the radio receiver so that it will be tuned to the radio frequencies of 640 kc. or 1240 kc., both of which are conelrad wave lengths.

A second example of the operation of the device of the present invention in accordance with FIGURE 2 is when the broadcasting station goes off the air at night, which is the case with most broadcasting stations. Recalling now for a moment, that the shorting bars 106 and 108 will be in the position shown in FIGURE 2 when the conelrad code is not being transmitted. That is to say, the decoder portion of the device of the present invention is in the position shown in FIGURE 2 when the decoder is in readiness for a cycle of operation. This becomes apparent from the fact that swinger 100 of relay K-1 is normally in the position shown in FIGURE 2, and positive voltage will be supplied to the motor 102 to drive the shorting bars 106 and 108 toward the right until they engage conductor strip S-2 and conductor strips S-10 and S-11, respectively, thereby disconnecting energizing potential from motor 102 since conductor strip S-2 is

connected to B+ potential terminal 84 via contact 99 of relay K-1.

When the broadcasting station goes off the air, the AVC voltage from the radio receiver will momentarily rise and cause transistor TR-1 to conduct, thereby energizing the coil 98 of relay K-1. Thus, the swinger 100 of relay K-1 will be in the position shown by the dotted lines. A positive voltage will then be applied to the motor 102 through the path including B+ potential terminal 84, lead 83, lead 85, contact 99, swinger 100, lead 103, conductor strip S-2, shorting bar 106, conductor strip S-8, lead 109, terminal 138, swinger 110, lead 117, terminal 128, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B+ potential terminal 84. Therefore, the motor 102 will drive the shorting bars 106 and 108 towards the right of switch SW-3. When shorting bar 106 engages conducting strip S-4 motor 102 is de-energized since energizing potential is no longer applied thereto. It is apparent that the momentary rise in AVC voltage when the broadcasting station goes off the air will continue for a period exceeding the required three seconds necessary for shorting bars 106 and 108 to reach conductor strip S-4.

When the shorting bar 106 engages conductor strip S-4, voltage is not applied to the motor since the contacts 100 of relay K-1 are not in the position as shown in FIGURE 2. However, since shorting bar 108 is engaging conductor strips S-9 and S-10, current is caused to flow through the resistor 104 by the series path including B- potential terminal 86, resistor 88, lead 95, lead 121, terminal 136, resistor 144, terminal 134, lead 111, conductor strip S-9, shorting bar 108, conductor strip S-10, lead 123, back to B- potential terminal 82. Thus, the resistor 144 begins to heat up as current flows therethrough. Since the broadcasting station is off the air for the night, current will flow through resistor 144 for a period exceeding twenty seconds, thereby causing swinger 110 of relay K-2 to move to the position shown by the dotted lines. Once swinger 110 moves to the position shown by the dotted lines, a negative voltage is applied across the motor 102 by the path including B- potential terminal 86, lead 123, conductor strip S-10, shorting bar 108, conductor strip S-11, lead 113, lead 115, terminal 142, swinger 110, lead 117, terminal 128, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B- potential terminal 86. The motor 102 will then drive the shorting bars 106 and 108 toward the left end of switch SW-3 until shorting bar 108 disengages conductor strips S-10 and S-11. The shorting bar 106 will stop in engagement with conductor strip S-1 and the motor will thereby stop since energizing potential for motor 102 is disconnected therefrom when shorting bar 108 disengages conductor strips S-10 and S-11.

Thus, it will be seen that when a broadcast station goes off the air due to non-transmission during the evening or unintended failure of the transmitter, the decoder does not connect the speaker 132 across the secondary 60 of output transformer T-1 and permit harsh or undesirable noises to emit therefrom.

When the broadcast station returns to the air, the AVC voltage will decrease to a level that is insufficient to maintain transistor TR-1 in a conducting state, thereby de-energizing coil 98 of relay K-1 and causing swinger 100 of that relay to return to the position as shown in FIGURE 2. When the swinger 100 of relay K-1 moves to the position shown in FIGURE 2, a positive voltage is again applied to motor 102 and the motor drives the shorting bars towards the right end of switch SW-3 until shorting bar 106 engages conductor strip S-2. Again, when shorting bar 106 engages conductor strip S-2, the energizing voltage is no longer applied to the motor 102 and the decoder remains in the position shown in FIGURE 2 in readiness for a conelrad code signal. It is to be recalled, that when conductor bar 108 moves out of engagement with conductor strips S-9 and S-10, current no

longer flows through resistor 144 and the swinger 110 will return to the position shown in FIGURE 2 after the resistor 144 cools off.

Thus, when the conelrad warning signal is again received by the device of the present invention, the above cycle of operation will be repeated.

Referring now to FIGURE 3, wherein the device of FIGURE 1 is modified so as to be responsive to not only the conelrad warning signal but also the NEAR warning signal.

As is well known, the NEAR warning system involves the use of existing transmission lines and networks, such as those employed by public and private utilities for the distribution of electric power. The NEAR system involves the injection into the power transmission lines and networks conventionally used in the homes, of harmonics of the standard frequency for power transmission, to wit, 60 cycles per second. The injection of harmonics of the 60 cycle frequency may be done in many ways, one of which is to code the injection in a manner similar to the code currently used in the conelrad warning system; that is to say, the harmonics of the 60 cycle frequency may be injected for a period of five seconds, then OFF for a second period of five seconds, and then ON for a third period of five seconds, and then ON for a period of fifteen seconds. Clearly, any form of code may be used so that spurious harmonics of the 60 cycle frequency would not result in the actuation of the alarm at the receiving end, such as the speaker 132 of the present invention.

For purposes of explaining, the modified device of the present invention, as shown in FIGURE 3, it will be assumed that the code used by the NEAR warning system is the same as the code used in the conelrad warning system.

For purposes of clarity and better understanding of the device shown in FIGURE 3, only the changes made in the system of FIGURE 3 over the system of FIGURE 2 will be discussed in detail. It is to be understood, that the remaining elements, which have been reference numerated with the same character as the corresponding elements in FIGURE 2, function and operate in the same manner as above set forth in detail respecting FIGURE 2.

Referring to the lower lefthand portion of FIGURE 3, wherein the components necessary to render the system responsive to the NEAR warning signal are schematically shown. The coil 66 of power transformer T-2 develops the harmonics of the 60 cycle frequency that has been injected and enhanced into the 110 volt, 60 cycle supply in any conventional manner well known to those skilled in the prior art. The secondary coil 200 of transformer T-1 is inductively coupled to the primary 66 of that transformer and is so wound that the voltage level applied to the lead 201 varies between plus 7 and minus 7 volts A.C. A series LC circuit comprising capacitor 202 and inductor 204 is connected in parallel to the secondary 200 of transformer T-1. The LC circuit 202-204 is series resonant to the specific harmonics of the 60 cycle frequency which has been injected into the power transmission lines. The coil 204 is the energizing coil for relay K-3 and the energization thereof causes the swinger 206 of relay K-3 to open or close. The swinger 206 of relay K-3 is connected to a parallel LC circuit comprising capacitor 212 and inductor 214. The swinger 206 is caused to engage terminal 213 when relay K-3 is energized. Terminal 213 is connected to B+ potential terminal 84 via lead 215. The other end of the parallel LC circuit 212-214 is connected via lead 207 to lead 95 which is connected to the slider of resistor 88. The coil 214 is the energizing coil for relay K-4 and when energized it controls the swinger 216 of that relay. Contact 218 of relay K-4 is connected via lead 205 to swinger 100 of relay K-1 and terminal 222 of relay K-4 is connected via lead 203 to contact 99 of relay K-1. The swinger 216 of relay K-4 is connected to B+ potential terminal 84 via lead 215. The harmonic frequency

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trapped in the series resonant circuit 202-204 is led via lead 201, swinger 208 of relay K-3, lead 25, resistor 24, and capacitor 26, to the base 28 of transistor TR-3. The energization of coil 204 of relay K-3 also causes swinger 208 to move to a first position wherein swinger 208 connects lead 23 to lead 25 and a second position wherein lead 201 is connected to lead 25. Thus, when the NEAR warning signal is received by the device of FIGURE 3, the relay K-3 causes the harmonic frequency to be delivered to the amplifying transistor TR-3. The swinger 208 is in the position shown when relay K-3 is de-energized.

Cycle of operation

A cycle of operation of the device set forth in FIGURE 3 when the NEAR warning signal is transmitted over the power transmission line is as follows: The 110 volt, 60 cycle, A.C. voltage and the enhanced harmonic of the 60 cycle frequency is inductively coupled from primary 66 to secondary 68 and 200, respectively, of transformer T-1. The rectification and filtering of the 110 volt 60 cycle voltage for developing the required D.C. potentials for the components of the device is the same as above set forth regarding FIGURE 2. The series resonant circuit 202-204 traps the harmonic signal and delivers it to lead 201. The coil 204 is thereby energized and swingers 206 and 208 of relay K-3 move to the positions shown by the dotted lines. When swinger 208 moves to the position shown by the dotted line the harmonic signal is delivered to the amplifying transistor TR-3 which amplifies and couples the harmonic signal to amplifier TR-2. The amplified harmonic signal is developed across the primary 58 of transformer T-1.

Referring back to the lower lefthand section of FIGURE 3, when swinger 206 of relay K-3 moves to the position shown by the dotted lines, energizing voltage is connected across the parallel LC circuit 212-214, via the path including B+ potential terminal 84, lead 215, contact 213, swinger 206, coil 204, leads 207 and 95, resistor 88, back to B+ potential terminal 84. Coil 204 of relay K-4 is thereby energized causing swinger 216 to move to the position shown by the dotted line, an energizing voltage is delivered to the motor 102 via the path comprising B+ potential terminal 84, lead 215, swinger 216, contact 222, lead 203, lead 103, conductor strip S-2, shorting bar 106, conductor strip S-8, lead 109, contact 138, swinger 110, lead 117, terminal 128, swinger 118, terminal 124, lead 119, terminal 89, terminal 87, lead 95, resistor 88, back to B+ potential terminal 84. The motor then drives the shorting bars 106 and 108 towards the right end of switch SW-3. If the harmonic frequency is continually transmitted for a period exceeding three seconds, the shorting bar 106 will clear the conductor strip S-3 and will then engage the conductor strip S-4, whereupon the energizing voltage to the motor 102 will be disconnected. If the harmonic of the 60 cycle frequency is discontinued in the same code manner as the conelrad signal is discontinued, the shorting bars will be caused to progressively engage and disengage the conductor strips until the shorting bar 106 engages conducting strips S-6 and S-7. Thus, as above set forth with regard to FIGURE 2, the secondary 60 of output transformer T-1 is coupled across the speaker 132 thereby inductively coupling the output of transistor TR-2 to the speaker 132.

It is to be understood that the thermal delay relay K-2 will be energized when voltage is applied across resistor 144 for a delay period of twenty seconds. That is to say, when shorting bar 108 engages conductor strips S-9 and S-10, voltage will be applied across resistor 144 through the path including B- potential terminal 86, lead 123, conductor strip S-10, shorting bar 108, conductor strip S-9, lead 111, terminal 134, resistor 144, terminal 136, lead 121, lead 95, resistor 88, back to B- potential terminal 86. Accordingly, should shorting bar 108 engage conductor strips S-9 and S-10 for a period exceeding

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twenty seconds, as is the case when the NEAR (or conelrad) code is not the cause for energizing motor 102 but some unintentional discontinuance of carrier wave signal, thermal delay relay K-2 will energize motor 102 so as to cause shorting bars 106 and 108 to return to their normal position as shown in FIGURE 3. Therefore, when the NEAR (or conelrad) code is being transmitted, shorting bar 108 will engage conductor strips S-9 and S-10 for a period not exceeding twenty seconds.

As above set forth, the thermal delay relay K-2 is caused to move to the position shown by the dotted line after a delay period of approximately twenty seconds whereupon the shorting bars 106 and 108 are caused to move toward the left end of switch SW-3 until shorting bar 108 runs off or disengages conductor strips S-9 and S-10. Thus, the switch SW-3 is returned to its normal position in readiness for a complete cycle of operation.

It is to be understood, that the swinger 100 of relay K-1 remains in the position shown in FIGURE 3 since the conelrad warning signal is not present and coil 98 of relay K-1 is de-energized.

Thus, it will be seen that the present invention provides a novel and unique radio warning device and/or power transmission network warning device capable of producing audible warnings of a conelrad and/or NEAR alert, and which may be used in the home or other site. The present invention may be incorporated in a small transistorized container and plugged into the conventional A.C. outlet of the home.

Further, it will be apparent from the foregoing that the use of the unique printed wiring switch SW-3 provides a novel method of preventing actuation of the speaker 132 upon the spurious existence of either a harmonic of the 60 cycle frequency on the transmission line or the absence of audio modulation on the carrier received by the radio receiver.

Still further, it will be apparent that the cooperating relationship between the thermal delay relay K-2 and the motor 102 uniquely returns the switch SW-3 to a position in readiness to operate upon receipt of either the conelrad or NEAR warning signal.

It will be apparent that the use of a stand-by storage supply uniquely provides economy in that the life of the battery in conjunction with the present invention is near the shelf-life thereof.

It will be further apparent from the foregoing that the device of the present invention is low in cost, rugged in construction and requires very little maintenance.

From the foregoing it will be seen that this invention is uniquely and unobviously adapted to obtain all of the ends and objects hereinbefore set forth together with other advantages which are obvious and which are inherent to the device.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the appended claims.

It is to be further understood that the parameters of the regenerative feedback circuit (56-58) are preferably designed so as to drive the rear-end of the transistor radio (18-20) into oscillation so that the audio tone (1000 c.p.s.) reproduced by the speaker 42 will continue until the switch 44 is moved to the LISTEN position. Of course, it is not necessary that the rear-end of the radio be driven into oscillation since the 1000 c.p.s. signal transmitted during the fourth interval of the conelrad signal code will be heard for approximately fifteen seconds.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range

of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A warning device responsive to a transmitted signal code comprising: a radio receiver having an audio amplifier and an automatic volume control circuit; a speaker; a decoder; an actuating relay; a thermal delay relay; a source of potential for proving the operating potentials for said device; said decoder comprising a first and second pair of spaced conductor strips, first and second shorting bars, and a reversible motor; said automatic volume control circuit intermittently energizing and de-energizing said actuating relay in accordance with said signal code; said actuating relay intermittently coupling and de-coupling said source across said motor in accordance with said signal code thereby causing said motor to sequentially step drive said first and second shorting bars toward said first pair of conductor strips; said second shorting bar always being in engagement with said second pair of conductor strips; said first shorting bar engaging said first pair of conductor strips after being step-driven a predetermined distance thereby connecting said audio amplifier to said speaker; said thermal delay relay being adapted to subsequently connect said source across said motor through said second pair of conductor strips and said second shorting bar thereby energizing said motor whereby said motor drives said first shorting bar out of engagement with said first pair of conductor strips and returns said first and second shorting bars to their normal position in said decoder.

2. A warning device in accordance with claim 1 and further including a regenerative feedback circuit connected between the input and output of said audio amplifier; and said first pair of conductor strips upon engagement by said first shorting bar rendering said feedback circuit operative.

3. A warning device in accordance with claim 2 wherein: said decoder further includes a third pair of conductor strips engageable with said second shorting bar; said thermal delay relay being coupled to said third pair of conductor strips so that said source will be coupled across said thermal delay relay when said second shorting bar engages said third pair of conductor strips whereby energizing potential is provided for said relay.

4. A warning device responsive to a transmitted signal code, comprising: radio receiver means; alert signaling means; decoding means for energizing said alert signaling means, said decoding means being responsive to said signal code; said alert signaling means being rendered operative in response to an output from said receiver means; said decoding means including relay means responsive to said signal code; switch actuating means; driving means for driving said switch actuating means; switch means for energizing said alert signaling means when actuated by said switch actuating means; said relay means sequentially energizing and de-energizing said driving means in accordance with said signal code; said driving means intermittently driving said switch actuating means a predetermined distance toward said switch means when energized by said relay means; said switch actuating means actuating said switch means, thereby energizing said alert signaling means; said device further including means for preventing operation of said driving means in response to false actuation of said decoding means.

5. A warning device responsive to a predetermined transmitted signal code, said code consisting of two successive five-second intervals of no signal code transmission separated by a five-second interval of signal code transmission and followed by a fifteen-second interval of audio modulated signal code transmission; said device comprising: a radio receiver; alert signaling means; decoding means for rendering said alert signaling means operative in response to an output from said receiver; said decoding means being responsive to said signal code; said decoding means comprising: relay means responsive to said

signal code; switch actuating means; driving means for driving said switch actuating means; switch means for energizing said alert signaling means when actuated by said switch actuating means; said relay means controlling said driving means in accordance with said signal code; said driving means driving said switch actuating means toward said switch when said driving means is energized by said relay; said switch energizing said alert signaling means; and device further including means for preventing operation thereof in response to interference signals.

6. A warning device responsive to a transmitted signal code comprising: a radio receiver having amplifying means; signal reproducing means; decoding means for connecting said signal reproducing means to said amplifying means; said decoding means responsive to said signal code; said signal reproducing means being operative to reproduce the output of said amplifying means; wherein said decoding means includes relay means responsive to said signal code; switch actuating means comprising a first shorting bar; motor means for driving said switch actuating means; switch means comprising a first pair of spaced conductor means connecting said amplifying means to said signal reproducing means when actuated by said switch actuating means; one of said first conductor means being connected to said amplifying means and the other being connected to said signal reproducing means; said relay means sequentially energizing and de-energizing said motor means in accordance with said signal code; and said motor means intermittently driving said switch actuating means a predetermined distance toward said switch means when energized by said relay means thereby actuating said switch means whereby said signal reproducing means is connected to said amplifying means; said motor means further driving said first shorting bar into engagement with said first conductor means whereby said amplifying means is connected to said reproducing means.

7. A warning device responsive to a transmitted signal code comprising: a radio receiver having amplifying means; signal reproducing means; decoding means for connecting said signal reproducing means to said amplifying means; said decoding means responsive to said signal code; said signal reproducing means being operative to reproduce the output of said amplifying means; wherein said decoding means includes relay means responsive to said signal code; switch actuating means comprising a first shorting bar; motor means for driving said switch actuating means; switch means comprising a first pair of spaced conductor means connecting said amplifying means to said signal reproducing means when actuated by said switch actuating means; one of said first conductor means being connected to said amplifying means and the other being connected to said signal reproducing means; said relay means sequentially energizing and de-energizing said motor means in accordance with said signal code; and said motor means intermittently driving said switch actuating means a predetermined distance toward said switch means when energized by said relay means thereby actuating said switch means whereby said signal reproducing means is connected to said amplifying means; said motor means further driving said first shorting bar into engagement with said first conductor means whereby said amplifying means is connected to said amplifier means; a second shorting bar; a second pair of spaced conductors; a thermal delay relay means; said motor means also driving said second shorting bar into engagement with said second conductor means; said second conductor means being connected through said thermal delay relay means to said motor means for causing said motor means to drive said first and second shorting bars away from said first and second conductor means; and said thermal delay relay means connecting said second conductor means to said motor means is caused to drive said first and second shorting bars away from said first and second conductor means.

8. A warning device responsive to a transmitted signal code comprising: a radio receiver having amplifying

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means; signal reproducing means; decoding means for connecting said signal reproducing means to said amplifying means; said decoding means responsive to said signal code; said signal reproducing means being operative to reproduce the output of said amplifying means; wherein said decoding means includes relay means responsive to said signal code; switch actuating means comprising a first shorting bar; motor means for driving said switch actuating means; switch means comprising a first pair of spaced conductor means connecting said amplifying means to said signal reproducing means when actuated by said switch actuating means; one of said first conductor means being connected to said amplifying means and the other being connected to said signal reproducing means; said relay means sequentially energizing and de-energizing said motor means in accordance with said signal code; and said motor means intermittently driving said switch actuating means a predetermined distance toward said switch means when energized by said relay means thereby actuating said switch means whereby said signal reproducing means is connected to said amplifying means; said motor means further driving said first shorting bar into engagement with said first conductor means whereby said amplifying means is connected to said amplifier means; a second shorting bar; a second pair of spaced conductors; a thermal delay relay means; said motor means also driving said second shorting bar into engagement with said second conductor means; said second conductor means being connected through said thermal delay relay means to said motor means for causing said motor means to drive said first

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and second shorting bars away from said first and second conductor means; said thermal delay relay means connecting said second conductor means to said motor means being caused to drive said first and second shorting bars away from said first and second conductor means; a rectifying circuit for developing operating potentials for said receiver and decoding means from an alternating current power supply responsive to harmonics of the frequency of said alternating current power supply transmitted through power transmission lines; said harmonics constituting said signal code; said receiver further including a tuned circuit coupled to said rectifying circuit and responsive to harmonics; said tuned circuit adapted to actuate said decoding means in accordance with said signal code; and said tuned circuit further adapted to deliver said harmonics to said input circuit of said amplifying means.

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